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Technical Dissertation

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Denver, CO

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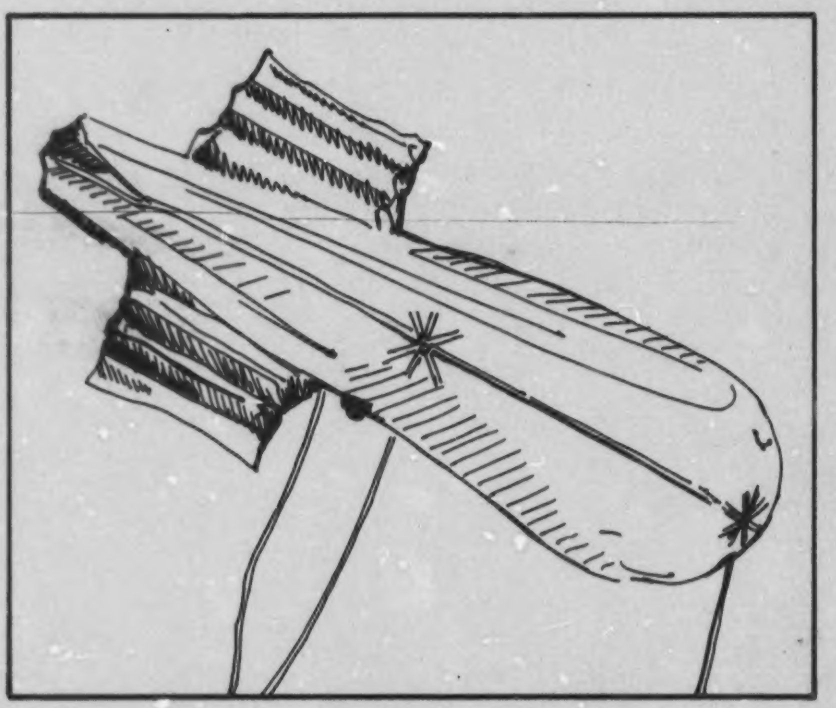

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16. ABSTRACT

An aerial monitoring system was developed to measure the noise produced in communities. The system consists of a tethered helium filled balloon which lifts an F.M. telemetry sound measuring system to altitudes of 300 m. A ground station receiving the telemetry signal demodulates it so that the noise at the microphone can be heard and analyzed on the ground. Measurements were taken at 10 sites in Boulder, Colorado, during the winter and summer seasons to evaluate the system's performance and to develop operational procedures. The test program revealed that the City of Boulder has on the average the same noise levels during the winter and summer seasons. Operational procedures for use of the system by communities were developed.

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AN AERIAL NOISE MONITORING STUDY
VOLUME I
TECHNICAL DISSERTATION

by

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68-01-3500

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FOREWORD

This report describes pioneering efforts in the development of hardware, techniques, and methods that have been used to measure noise levels above a community by means of an instrument suspended under a tethered balloon. The described developments go a long way toward proving the applicability of concepts that were first proposed in this Directorate. A suitable foundation now exists upon which aerial noise monitoring should be further proven in a real-world environmental noise study, during which, and before additional instrument packages are fabricated, the need for further refinements should be studied.

Robert L. Duprey, Director
Air & Hazardous Materials Division
Region VIII
United States Environmental Protection
Agency

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Projects involving the interfacing of technology, regulations, and community support are successful because of the efforts of many individuals. Credits are given to: J. V. Adams, Environmental Protection Officer for the City of Boulder, Colorado, for his support of flight operations and evaluation of the field equipment; E.E. McKenna of the University of Colorado for the fabrication and testing of the early prototype aerial system; W. Bryan of the U. S. EPA, Region VIII, for his technical review of the electronic designs and assistance in the preparation of this report; S. Rossi of Engineering Dynamics, Inc. for the construction and testing of the final flight system; J. Ruth of Engineering Dyanmics, Inc., for site selection and data analysis.

SECTION 1

INTRODUCTION

This project is directed towards filling a gap in information that is required to fulfill some of the mandates of the Noise Control Act of 1972. Present environmental noise monitoring schemes in communities are adaptions of monitoring schemes developed specifically for measuring specific noise sources. For example, airports and highways have been monitored and prediction schemes for them have been developed. Thus, an acoustic measurement at a known point can provide a basic input to the prediction scheme which can then be used to predict noise levels at many other points. The measure we most commonly refer to is the acquisition of cumulative distrubutions of the A weighted sound pressure level at a number of ground stations whose locations have been judiciously chosen. When the method is transferred to general community monitoring where there is a multitude of noise sources the criterion for monitoring station locations is lost, i.e., the relationship between station and receiver is much less deterministic than it was between station and noise source.

To overcome the problem, a large increase in monitoring stations is required to achieve a degree of statistical validity. Even if this is done, the objectives of getting valid measures of the intensity and extensity of the noise in an entire community, and finding the environmental noise exposure of people, cannot be accomplished with any degree of accuracy. In essence, present monitoring schemes are not adequate to measure the noise exposure to humans, and imprecise extrapolations must be made to achieve the above objectives when relating to the residents of the community. However, little work has been done to develop a more discriminating monitoring method.

In an effort to achieve these objectives a program has been initiated by the U. S. EPA to develop an aerial sound monitoring system. Earlier experiences by the U. S. EPA, Region VIII in 1975 showed the concept to be not only feasible but technically practical with state-of-the-art electronics. A moored balloon was flown and acoustic data were transmitted to a ground station. As a result of these exploratory tests a more formal aerial monitoring system deveopment program was initiated by Engineering Dynamics, Inc., under a contract to Region VIII of the EPA.

The purpose of the program was to determine if the aerial monitoring concept could be developed into a hardware package that could be used by communities to determine the existing noise environment and to measure the improvement in the environment with time. Because the program was exploratory there were many unknowns that were dicovered during the course of the program. The impact of these unknowns is discussed herein.

Volume I of this report discusses the design, performance and flight test results of the program. Volume II is an operations handbook to be used by community noise control personnel in the operation and application of the aerial package and ground station.

SECTION 2

CONCLUSIONS

An aerial noise monitoring system can be developed that can accurately measure the noise radiating from a community below. The system can be flown successfully to altitudes of 914 m. At 914 m. the atmospheric absorption is significant and the A weighted sound pressure levels can be as much as 5 dB low, depending on relative humidity.

The exploratory tests conducted over the City of Buulder, Colorado, indicate that the optimum altitude is about 275 m. Below 60 m. the effects of shielding (acoustical screening) due to trees and buildings affect (usually by lowering) the A weighted levels. This altitude can vary from site to site and must be determined for each site if low altitude (levels below 100 m.) measurements are to be taken.

The project revealed many factors which must be taken into consideration that are constraints. Persons planning to conduct an aerial monitoring program must recognize that delays or interruptions will occur due to adverse weather, obtaining clearances from the FAA when flying near airports, obtaining a permit from the FCC to use the 400 MHz telemetry band, and acoustic artifacts which can negate data collected over several days.

The aerial systems can be operated by communities provided the personnel completely understand the instructions in the handbook (Volume II) and have a working knowledge of acoustic measurements.

The electroacoustic performance of the aerial system developed under this contract will meet the requirements set forth by ANSI for a Type II Sound Level Meter.

SECTION 3

RECOMMENDATIONS

A program should be established to allow at least 10 communities to operate the aerial monitoring system for a period of one month. This program should be accomplished with the equipment developed as part of this contract.

The balloon should be flown at an elevation of 275 m. whenever that is possible within limitations established by the F.A.A. or other local, state or governmental agencies.

The mooring line to the balloon must have a load rating of at least 130 kg. The 45 kg. test line used for the exploratory tests was marginal under adverse weather conditions.

If the system is to be used on a regular basis or if more systems are to be fabricated a telemetry controlled destruct system must be incorporated to avoid the loss of the aerial package in the event the mooring line breaks.

The existing telemetry receiver is too complex and should be replaced with one having crystal frequency controls and a minimum of controls.

SECTION 4

SYSTEM DESCRIPTION

PHYSICAL DESCRIPTION OF TELEMETRY PACKAGE

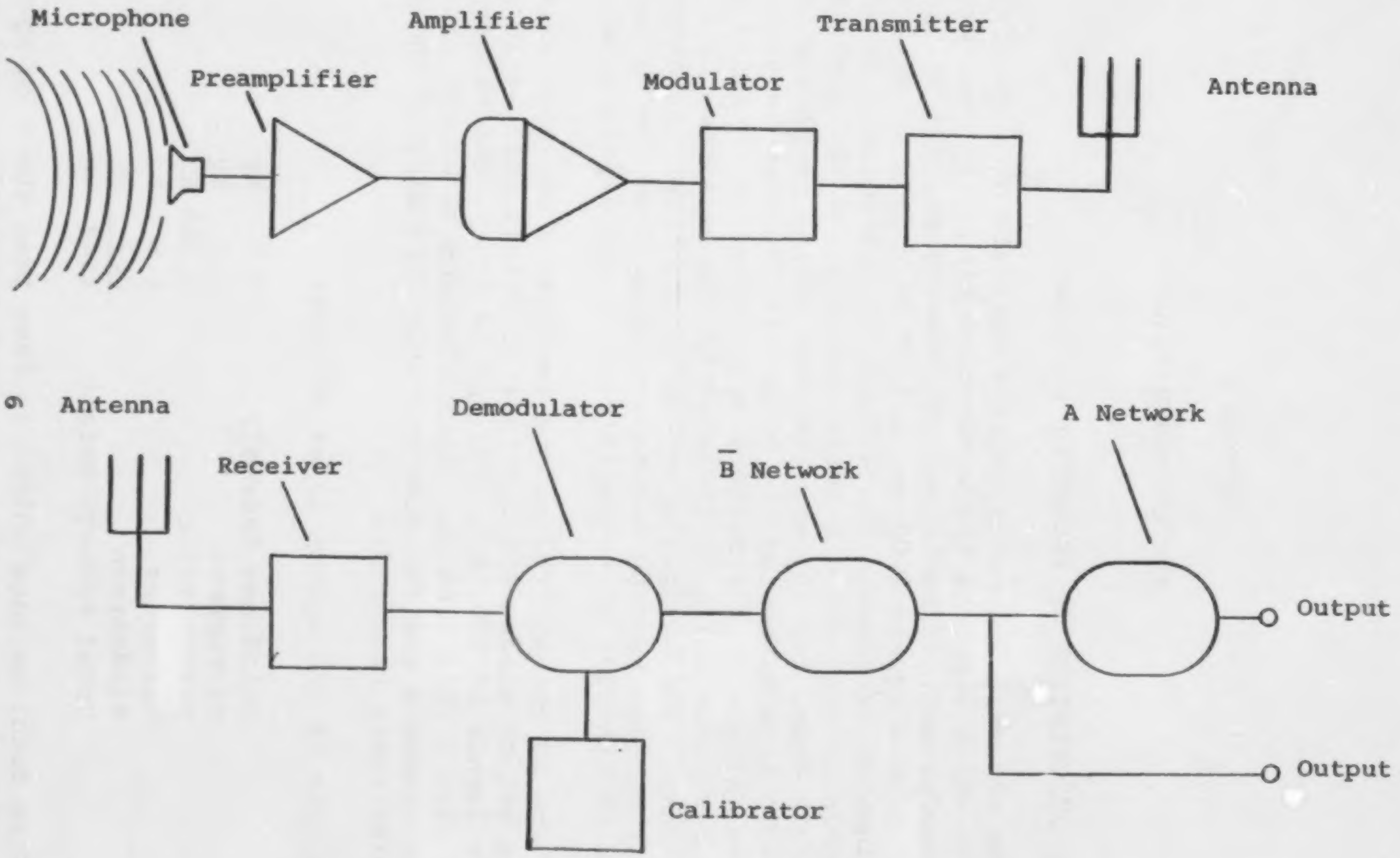
The acoustic telemetry package consists of a mainframe structure which supports the electronic circuitry, battery pack, microphone/preamp, transmitter, and windscreen. The mainframe is machined from a square 5.08 cm. x 5.08 cm., 0.32 cm wall thickness, aluminum extrusion. The 400 MHz FM transmitter is attached to the main printed circuit board assembly and the transmitter and circuit board are in turn fastened to the mainframe structure. Two 11 volt size batteries are housed in the rear section of the mainframe. Access to the battery compartment is obtained by removing the backplate which is fastened to the mainframe by 2 air-loc fasteners. The backplate serves as the interface between the telemetry package and the suspension lines from the balloon. Attached to the side of the mainframe is the dipole antenna.

There is one control on the package, a dB range switch. The dB range switch allows the operator to select full scale sound pressure levels of 120, 100, 80, and 60 dB(A). The mainframe is covered with a thin 0.04 cm. thick aluminum sheet for protection from the elements and for electrostatic shielding of the low level electronic circuitry.

Weight of the system is as follows:

Mainframe Assembly	0.5	kg
Microphone	0.1	kg
Preamplifier	0.085	kg
Batteries	0.6	kg
Windscreen	0.2	kg
Total Package Weight	1.48	kg

This total package weight is less than the 2 kg specification. A second aerial package has been provided as part of the contract and is identical to the first unit described herein.


Microphone
Preamplifier
Amplifier
Modulator
Transmitter
Antenna
Antenna
Receiver
Demodulator
$\overline{B}$ Network
A Network
Output
Output
Calibrator

BLOCK DIAGRAM OF ACOUSTIC TELEMETRY PACKAGE

Figure I

ELECTRICAL AND ELECTRO-ACOUSTIC CIRCUITRY DESCRIPTION

General Description

The audio signal (see Figure 1) is transduced by the microphone and the electrical signal from the microphone is fed via a preamp and attenuator to a voltage controlled oscillator having a center frequency of 80 KHz. The FM signal is fed to a 400 MHz FM transmitter and the RF signal is transmitted to the ground receiver. The receiver converts the 400 MHz signal to the 80 KHz FM subcarrier, and the FM subcarrier is fed to a demodulator circuit and then to weighting circuits which provide A and C weighted outputs for tape recorders, level recorders or sound level meters.

Microphone

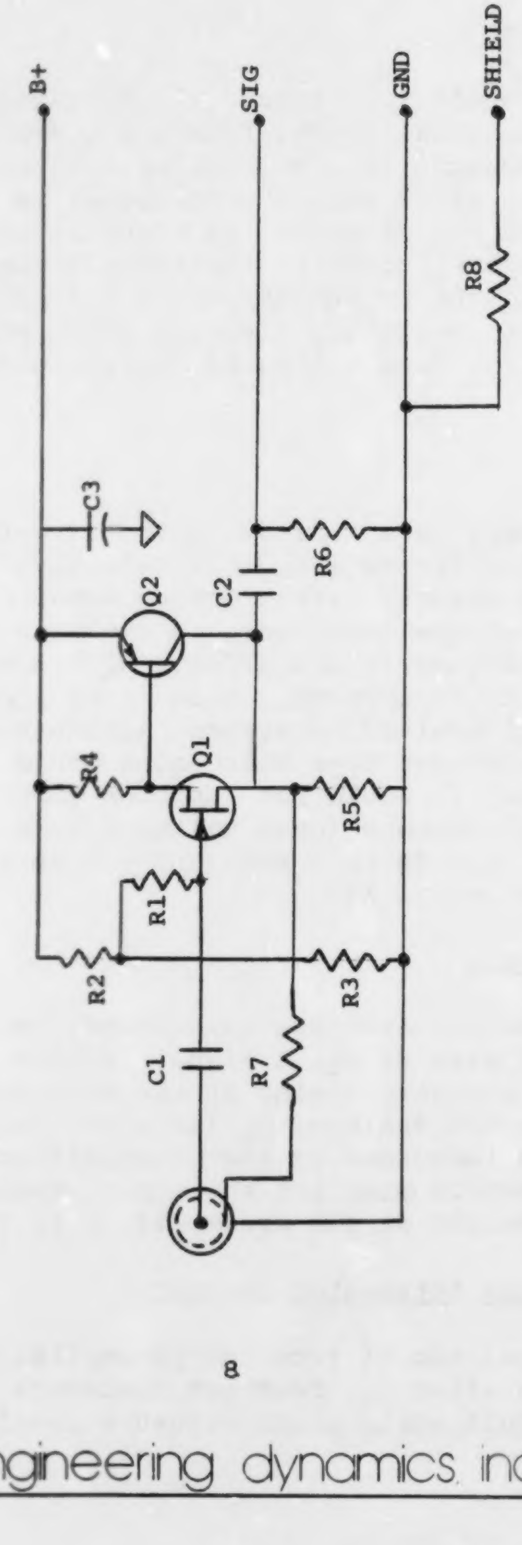
The microphone is a 2.37 cm. diameter ceramic microphone (GenRad Model 1961) having a nominal sensitivity of -40dB re 1 $V/N/m^2$ and a temperature coefficient of about 0.001 dB/deg. C. Source impedance of the microphone is equivalent to 385 pf. with a temperature coefficient of 2.2 pf/deg. C. The microphone will operate normally up to 100% RH, which is an important consideration for an aerial monitoring system. Although an equivalent size and sensitivity electret type microphone would have better frequency response, it would not function above 90% RH. Frequency response of the microphone (open voltage) is better than ± 1 dB from 20 to 2 KHz, ± 4 dB to 5 KHz, and ± 6 dB at 10 KHz. Weight of the microphone is 0.1 kg.

Preamplifier Circuit

The input signal from the microphone (see Figure 2) is fed through C_1 to the gate of Q_1. A signal is taken from the source of Q_1 and drives the shield ring at the microphone connector. Q_2 is driven from the drain of Q_1 for stabilization purposes. The output source impedance of the preamplifier (GenRad Model 1933-4795) is about 20 ohms and the imput impedance is greater than 100 Mohms. Weight of the preamplifier is 0.085 kg.

Audio Amplifier and Attenuator Circuit

The electrical signal from the preamplifier (see Figure 3) is fed to the amplifier Q_1. Feedback resistors of Q_1 are switched to set gain for full scale sound pressure levels of 120, 100, 80,


B+
SIG
GND
SHIELD
R8
C3
Q2
C2
R6
R4
Q1
R5
R1
R2
R3
C1
R7

PREAMPLIFIER CIRCUIT

Figure 2

Preamplifier Circuit Component List

Capacitors:

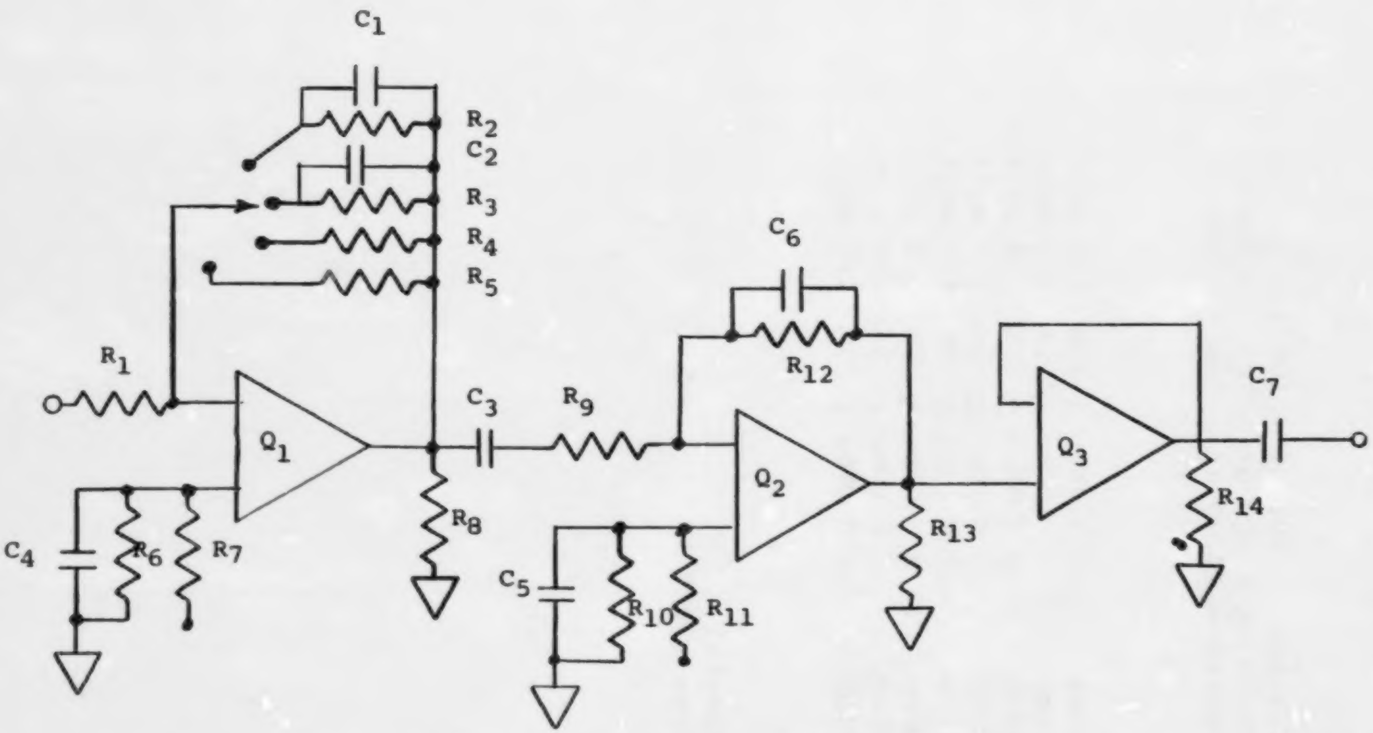
C_1	Ceramic	.001 uf	± 10%	100 VDC
C_2	Tantalum	6.800 uf	± 20%	15 VDC
C_3	Tantalum	10.00 uf	± 20%	30 VDC

Resistors:

R_1	comp.	2.2 G ohms	± 20%	1/8 watt
R_2	comp.	100.0 K ohms	± 5%	1/3 watt
R_3	comp.	75.0 K ohms	± 5%	1/8 watt
R_4	comp.	3.0 K ohms.	± 5%	1/3 watt
R_5	comp.	4.7 K ohms	± 5%	1/3 watt
R_6	comp.	100.0 K ohms	± 5%	1/3 watt
R_7	comp.	3.0 K ohms	± 5%	1/8 watt
R_8	comp.	2.2 K ohms	± 5%	1/8 watt

Transistors:

Q_1	Special
Q_2	Type D30A3


C1
R2
C2
R3
R4
R5
C6
R1
C3
R9
R12
C7
Q1
Q2
Q3
R8
C4
R6
R7
C5
R10
R11
R13
R14

AUDIO AMPLIFIER AND ATTENUATOR CIRCUIT

Figure 3

Audio Amplifier and Attenuator Circuit Component List

Capacitors:

C_1	Ceramic	.0005	uf	± 10%	
C_2	Ceramic	.005	uf	± 10%	
C_3	Film	.82	uf	± 20%	
C_4	Tantalum	10.00	uf	± 20%	25 VDC
C_5	Tantalum	10.00	uf	± 20%	25 VDC
C_6	Mica	50.00	pf	± 20%	
C_7	Film	.10	uf	± 20%	

Resistors:

R_1	Comp.	1.0	K ohm	± 5%	¼ watt
R_2	Metal film	15.0	K ohm	± 1%	¼ watt
R_3	Metal film	1.5	K ohm	± 1%	¼ watt
R_4	Metal film	150.0	K ohm	± 1%	¼ watt
R_5	Metal film	15.0	K ohm	± 1%	¼ watt
R_6	Comp.	100.0	K ohm	± 5%	¼ watt
R_7	Comp.	100.0	K ohm	± 5%	¼ watt
R_8	Comp.	6.2	K ohm	± 5%	¼ watt
R_9	Comp.	8.2	K ohm	± 5%	¼ watt
R_{10}	Comp.	100.0	K ohm	± 5%	¼ watt
R_{11}	Comp.	100.0	K ohm	± 5%	¼ watt
R_{12}	Comp.	100.0	K ohm	± 5%	¼ watt
R_{13}	Comp.	6.2	K ohm	± 5%	¼ watt
R_{14}	Comp.	1.0	K ohm	± 5%	¼ watt

Integrated Circuits:

Q_1	Type LM124A
Q_2	Type LM124A
Q_3	Type LM124A

and 60 dB(A). The coupling circuit between Q_1 and Q_2 functions as a high pass filter with a 3 dB point at 250 Hz. This high pass filter results in the circuit having a B weighted frequency response. (Refer to Figure 3). Q_2 is a fixed gain amplifier and drives the output buffer source follower Q_3. All items in this section were made by Engineering Dynamics, Inc.

Modulator Circuit

The B weighted signal from Q_3 (see Figure 4) of the audio amplifier is fed to Q_1 of the modulator circuit.

The modulator operates at a quiescent frequency of 80 KHz and is frequency modulated ± 20% by full scale signals of 120, 100, 80, or 60 dB(A) as controlled by the range switch. This 80 KHz subcarrier was used to modulate the 400 MHz carrier. By using the subcarrier technique both signal to noise ratio and the low frequency response of the system are improved.

FM Transmitter

The design details of the FM transmitter circuit (SCI System Inc. Model TMET-400-FM) are proprietary to the manufacturer and therefore cannot be replicated in this document. However, the manufacturer's published specifications are as follows:

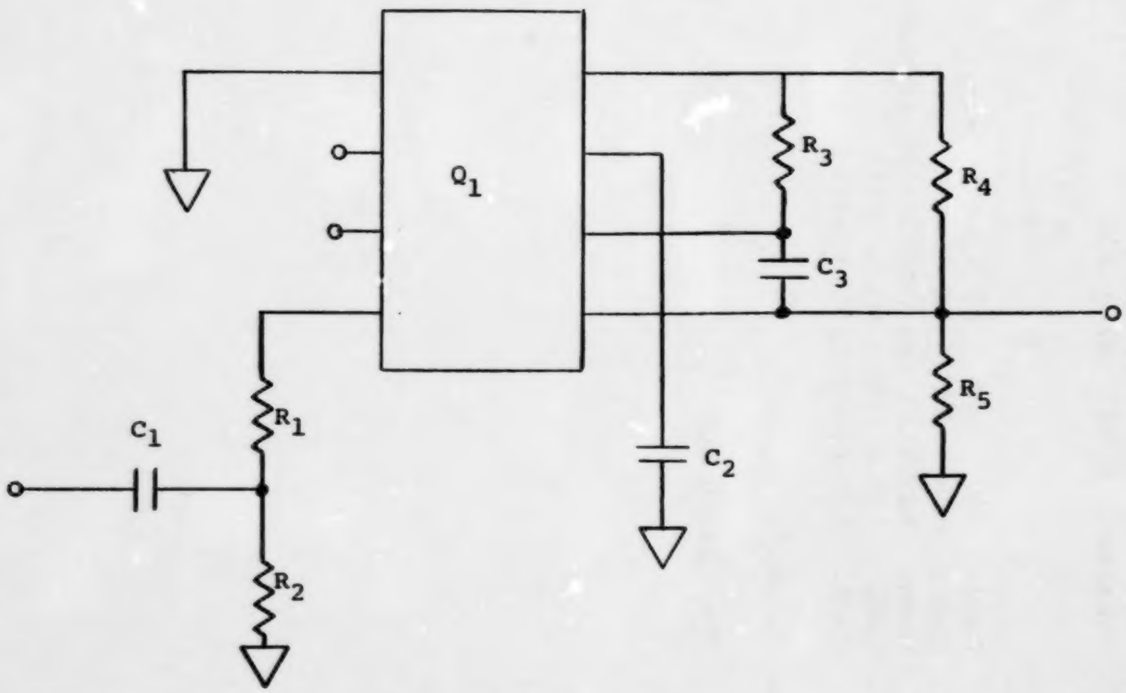
Weight	0.047 kg
Frequency range	391 to 405 MHz
Residual FM	750 Hz PK
Output power	10 mw
Input current	21 ma
Modulation voltage	62 mv rms at 100 KHz peak Dev.

The output of the transmitter is fed to a dipole antenna.

Now, if we have an 80 KHz subcarrier and 750 Hz residual on the carrier then the subcarrier will have a residual of about 1 Hz, as a result of the heterodyning process. Full scale sound pressure level on any range is 20% deviation of 80 KHz, or 16 KHz, and a 1 Hz residual is equivalent to a noise floor of -84 dB from full scale, much lower than we can expect from the audio system which will be discussed later on in this document.

Telemetry Receiver

Detailed schematics of the telemetry receiver (Microdyne


Q$_1$
R$_1$
R$_2$
C$_1$
C$_2$
R$_3$
C$_3$
R$_4$
R$_5$

MODULATOR CIRCUIT

Figure 4

Modulator Circuit Component List

Capacitors:

C_1	Film	0.100	uf	± 20%
C_2	Mica	220.000	pf	± 20%
C_3	Ceramic	0.001	uf	± 20%

Resistors:

R_1	Comp.	740	ohm	± 5%	¼ watt
R_2	Comp.	680	ohm	± 5%	¼ watt
R_3	Comp.	Adjusted for modulation frequency			
R_4	Comp.	100	K ohm	± 5%	¼ watt
R_5	Comp.	600	K ohm	± 5%	¼ watt

Integrated Circuit:

Q_1 Type 2M566 VCO

Model 1100-AR with RF Tuner Model 113-T(A) are considered trade secrets by the manufacturer and therefore cannot be replicated in this document. Performance specification of the receiver are published data with no restrictions and are as follows:

Receiver type	Double superheterodyne, 50 MHz first lF, 10 MHz second lF.
Frequency range	285 to 410 MHz
Noise figure	7.5 dB maximum
Image rejection	80 dB
IF Rejection	90 dB
Tracking range	± 400 KHz; ± 250 KHz fine tune control
Weight	20 kg

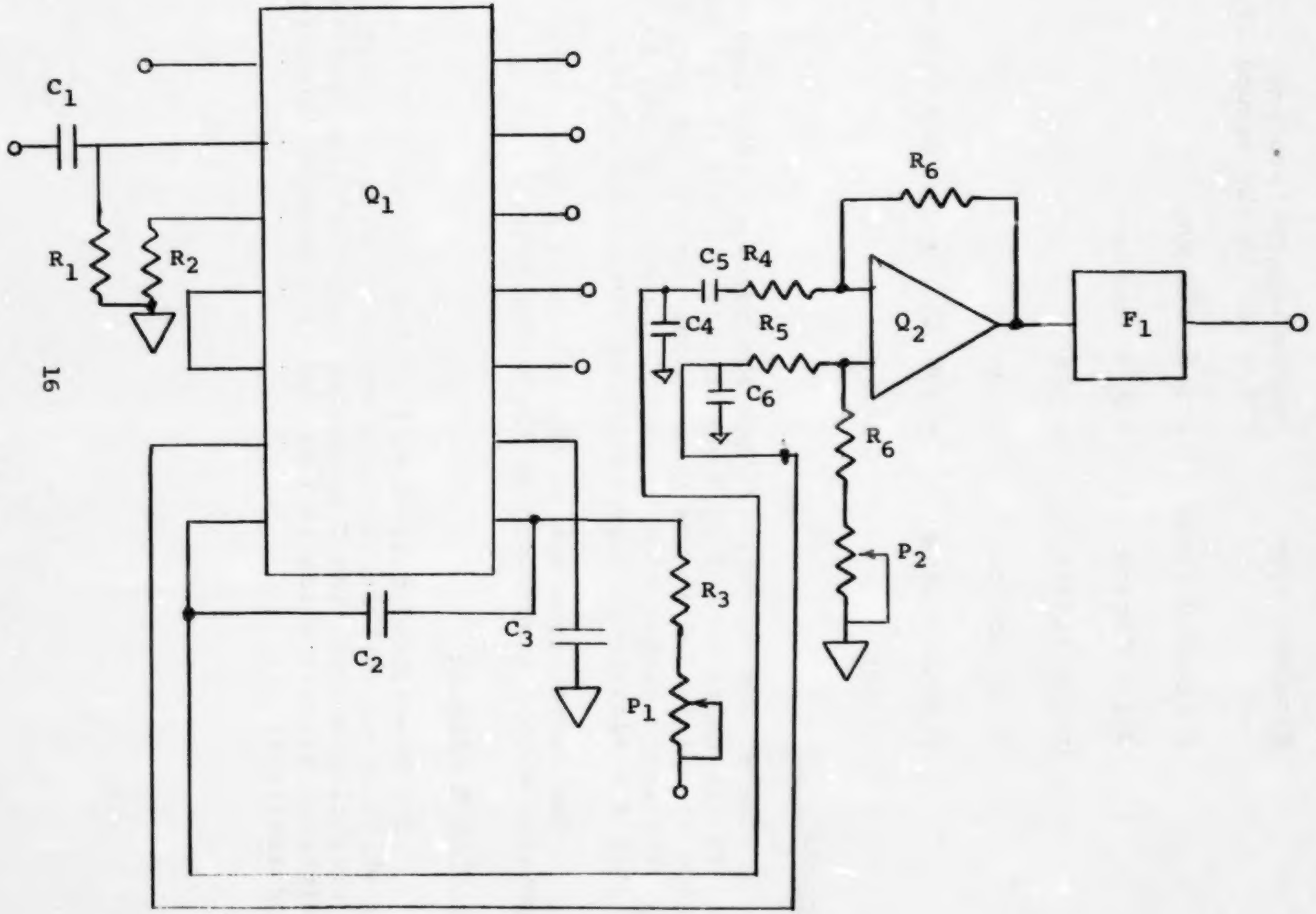
Demodulator

The 80 KHz subcarrier from the receiver (see Figure 5) is fed to the phase lock loop demodulator, Q_1, and the variable phase signal is fed to the phase-adder circuit and output filter, Q_2. The audio output from Q_2 is fed through a 20 KHz low pass filter for additional suppression of the 80 KHz carrier.

The output from the 20 KHz filter is a B weighting of the acoustic signal transduced by the microphone.

Weighting Circuit

The B weighted data signal is fed to a circuit (see Figure 6) which is an inverse of the B weighting network, thus giving a C weighting output. The C weighting output is then fed to an A weighting circuit which is then fed to a graphic level recorder for analysis.


C1
R1
R2
Q1
C2
C3
P1
R3
C5
R4
C4
R5
C6
R6
P2
Q2
R6
F1

DEMODULATOR Figure 5

Demodulator Circuit Component List

Capacitors:

C_1	Film	.010	uf	± 20%
C_2	Ceramic	.001	uf	± 20%
C_3	Ceramic	.002	uf	± 20%
C_4	Ceramic	.001	uf	± 20%
C_5	Film	.120	uf	± 20%
C_6	Film	.100	uf	± 20%

Resistors:

R_1	Comp.	1	K ohm	± 5%	¼ watt
R_2	Comp.	1	K ohm	± 5%	¼ watt
R_3	Comp.	4.7	K ohm	± 5%	¼ watt
R_4	Comp.	47.0	K ohm	± 5%	¼ watt
R_5	Comp.	47.0	K ohm	± 5%	¼ watt
R_6	Comp.	470.0	K ohm	± 5%	¼ watt
R_7	Comp.	550.0	K ohm	± 5%	¼ watt

Potentiometers:

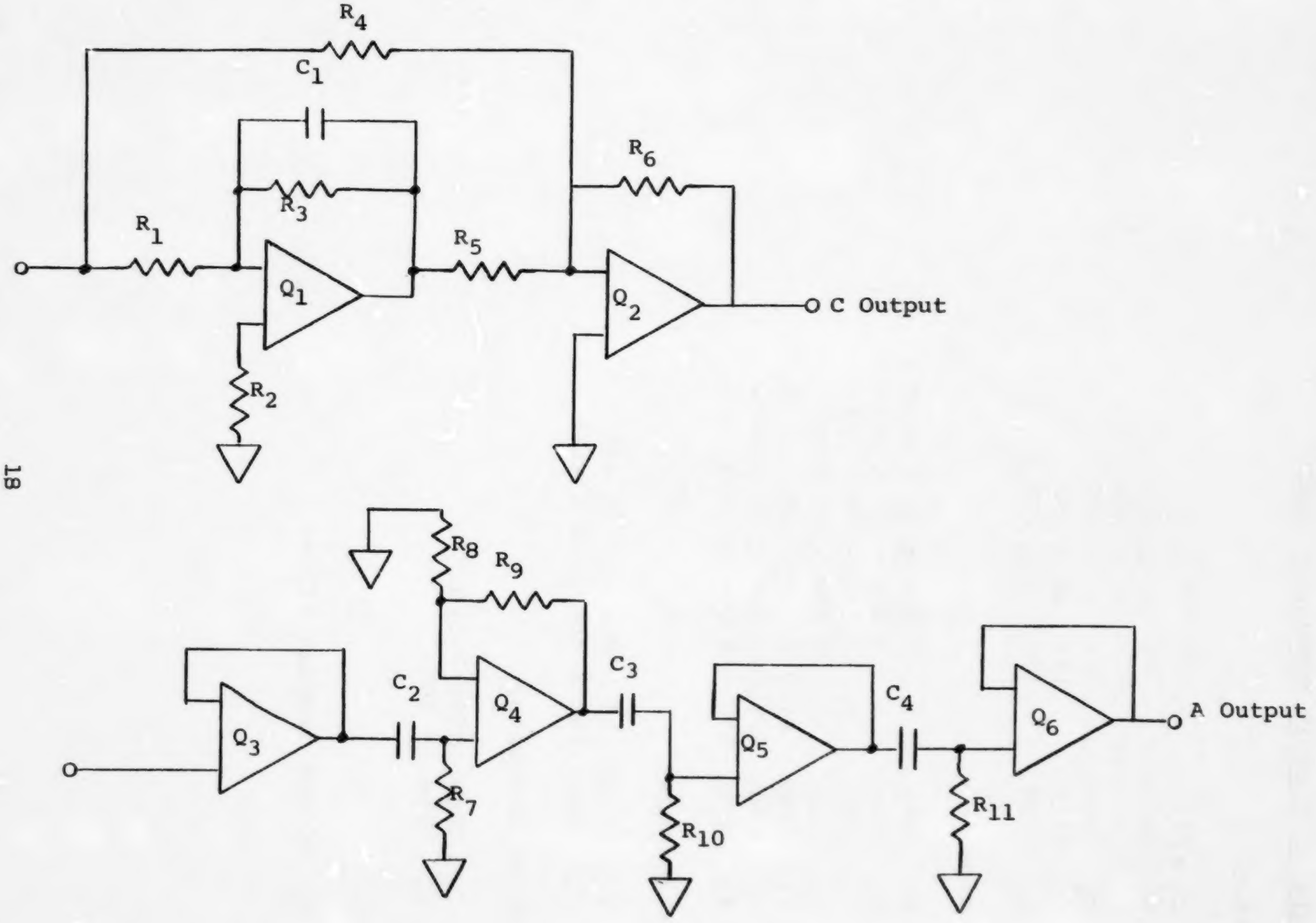
P_1	Comp.	10	K ohm	± 5%	¼ watt
P_2	Comp.	100	K ohm	± 5%	¼ watt

Integrated Circuits:

Q_1	Type LM565 P.L.L.
Q_2	Type LM 307

Filter:

F_1 20 KHz lowpass filter


R4
C1
R3
R1
R5
R6
R2
Q1
Q2
C Output
R8
R9
C2
C3
C4
Q3
Q4
Q5
Q6
R7
R10
R11
A Output

WEIGHTING CIRCUITS

Figure 6

Weighting Circuit Component List

Capacicors:

C_1	Film	.67	uf	± 20%
C_2	Film	.27	uf	± 20%
C_3	Film	.1	uf	± 20%
C_4	Film	.02	uf	± 20%
C_5	Ceramic	.0013	uf	± 20%
C_6	Ceramic	250	uf	± 20%

Resistors:

R_1	Comp.	10.0	K ohm	± 5%
R_2	Comp.	4.9	K ohm	± 5%
R_3	Comp.	10.0	K ohm	± 5%
R_4	Comp.	50.0	K ohm	± 5%
R_5	Comp.	5.0	K ohm	± 5%
R_6	Comp.	50.0	K ohm	± 5%
R_7	Film	13.3	K ohm	± 1%
R_8	Film	51.1	K ohm	± 1%
R_9	Comp.	10.0	K ohm	± 5%
R_{10}	Film	13.3	K ohm	± 1%
R_{11}	Film	13.3	K ohm	± 1%

Integrated Circuits:

Q_1	Type LM307
Q_2	Type LM307
Q_3	Type LM307
Q_4	Type LM307
Q_5	Type LM307
Q_6	Type LM307

MOORED BALLOON SYSTEM

Balloon

The balloon is an expendable item because it is fabricated of thin plastic film and can be punctured very easily. Experience has shown that the balloon is good for about 2 weeks of normal usage. The balloon is 4.9 m. in length and 1.4 m. in diameter, weighs 1.7 kg., and has a nominal volume of 3.25 m^3. As the balloon rises the helium expands and the volume of the balloon increases. This expansion partially affects the loss of lift with altitude.

The aerial package balloon when filled in accordance with the manufacturer's instructions will have a volume of 3.257 cubic meters. The buoyancy of the balloon is the difference in density between the gas in the balloon and the surrounding atmosphere. At sea level and 15°C the atmospheric density is 1.225 kg/m^3 (Standard Atmosphere Table, NASA Report 1235). At 0°C the density is 1.2927 kg/m^3. The density of helium at these same conditions is 0.1784 kg/m^3. For a helium filled balloon of 3.257 cubic meters the buoyancy is determined by the following equation derived by Morris, et al, in the Bulletin of the American Meteorological Society, Vol. 56, No. 9 Sept., 1975:

$$B = (1.056)\ V_b \exp\ (-9.8 \times 10^{-5} Z)$$

Opposing the buoyancy of the balloon is the weight of the balloon, its rigging, and the aerial monitoring package, which equals 2.72 kg. A variable load is the tether line, whose weight is proportional to the altitude and is .0005 kg. per meter, as used in this study.

Using these factors the lift of the balloon under no-wind conditions is:

$$L = (1.056) V_b \exp\ (-9.8 \times 10^{-5} Z)$$

so:

$$L = (3.44) \exp(-9.8 \times 10^{-5} Z)$$

The following table shows the lift of the aerial monitoring system when flying in the standard atmosphere:

Altitude Z (meters, MSL)	Lift (kg)	Load
0	3.44	-2.72
100	3.41	-2.77
200	3.37	-2.82
300	3.34	-2.87
400	3.31	-2.92
500	3.28	-2.97
600	3.24	-3.02
700	3.21	-3.07
800	3.18	-3.12
900	3.15	-3.17
1000	3.12	-3.22

The above table shows that under no-wind conditions the balloon with the aerial package can be flown to about 1000 meters. Aerodynamic lift can be obtained from the wind and the balloon can be flown at heights greater than 1000 meters. Flights as high as 2000 meters have been achieved by others.

Balloon Rigging

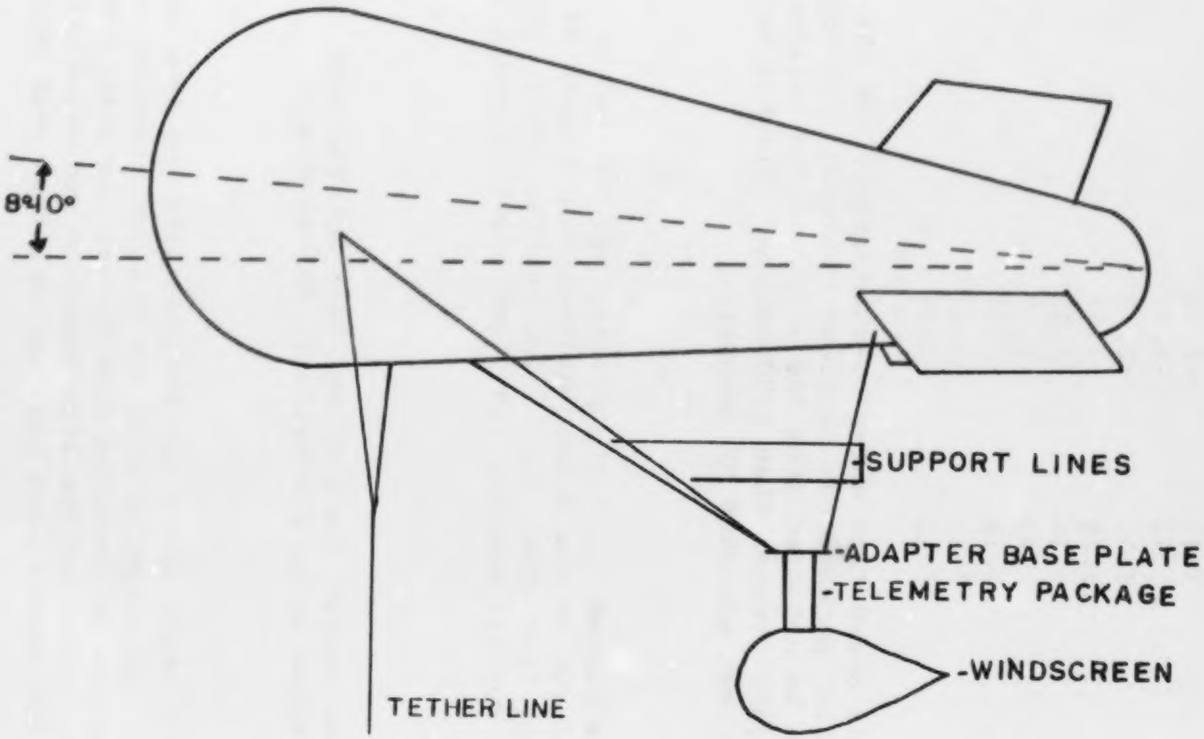
The balloon is rigged via 4 tie points, two located at the bottom front and two at the bottom midrear (see Figure 7). The rigging is 45 kg. test nylon cord. Two bridles are formed from the tie points; one for all mooring line, and one to support the aerial package.

Mooring Line

The balloon was moored via a 45 kg. test monofilament fish line, which was attached to an electrically driven winch.

Site Elevation

The above table which shows the balloon lift and load as a function of altitude was computed with the balloon starting at sea-level. When the balloon is launched from higher elevations the term in parenthesis (1.056) of the lift equation reduces slightly. Flights as high as 800 meters have been accomplished near Boulder, Colorado.



840°
SUPPORT LINES
-ADAPTER BASE PLATE
-TELEMETRY PACKAGE
-WINDSCREEN
TETHER LINE

Figure 7

Winch

An electrically operated winch was constructed for reeling in and out the balloon line. The winch operates from a 12 volt battery that allows operation from a vehicle. The winch is equipped with a Simmons safety switch which automatically stops the mechanism if the balloon rigging contacts the winch. Without the safety switch the balloon bridle lines could be drawn into the winch.

The power drain increases as a direct function of the lift of the balloon. Under normal operating conditions (i.e., still flight) power consumption is approximately 12 watts. Winch speed is non-uniform and is a function of the aerodynamic lift on the balloon. Reeling in the balloon is approximately twice as fast as reeling out the balloon under equal load conditions.

SECTION 5

SYSTEM PERFORMANCE AND PERFORMANCE TESTS

PERFORMANCE SPECIFICATIONS

The following performance specifications were required to be met as fulfillment of the contract under which this project was conducted. The specifications are replicated below and following them is a description of the tests conducted to verify that the system met the performance specifications.

The total weight of the instrument package will be less than two kilograms.

It shall be possible to manufacture the instrument at a cost of less than 800.00 dollars, excluding the transmitter.

The usable temperature range of the instrument package shall be from minus five (5) degrees centigrade to fifty (50) degrees centigrade with intermittent calibration of the equipment allowed.

The accuracy specified below must be maintained with temperature variations of plus or minus 10 degrees centigrade without recalibration of the aerial package.

The Contractor shall provide a microphone wind screen which will optimize the trade-off between flyability and minimization of wind-induced noise. (See (5) below under Performance Criteria).

The system must be easy to operate by individuals possessing the expertise typical of Region VIII community noise control personnel.

The instrument package must be capable of demonstrating on the ground a performance level which satisfies the performance criteria listed below, with instrument package FM receiver separations throughout the range from 6.1 meters to 152 meters.

Performance Criteria

(1) Signal to noise ratio: greater than 40 dB.
(2) Measurement range: 30 dB(A) to 120 dB(A).
(3) D namic range: 40 dB.
(4) Accuracy: ± 0.5 dB(A).
(5) Wind tolerance: such that the trade off between the flyability of the balloon and the minimization of wind induced noise is optimized.
(6) Quality of analog data collected: must be sufficient to allow source identification, audio demonstration, and digital analysis of the data and otherwise satisfy the following criteria:
    (a) total harmonic distortion of less than 2% at full scale.
    (b) frequency response within tolerances of ANSI' Type 2 Standards.
    (c) Signal to noise ratio greater than 40 dB.

The Contractor shall construct one (1) aerial instrument package capable of satisfying the design and performance criteria specified herein.

The Contractor shall demonstrate and document to the satisfaction of the Project Officer that the above design and performance criteria are satisfied by the instrumentation system with appropriate experiments conducted on the ground.

The Contractor shall demonstrate satisfactory performance of the aerial package to the Project Officer as it is flown and operated at a location which is acoustically representative of community noise in Region VIII throughout the range of altitudes varying from 6.1 meters to 152 meters above the ground. Satisfactory performance has been demonstrated when the following performance criteria have been met:

(1) The aerial instrument package and receiving accoutrements must be durable enough to withstand general handling without significant performance loss as specified below:
    (a) signal to noise ratio: greater than 40 dB.
    (b) accuracy: ± 1 dB; may be demonstrated with calculated noise levels resulting from ground sources.

The Contractor shall develop a proposed aerial monitoring methodology and present this information to the Project Officer.

The Contractor shall choose and identify several sites that collectively are representative of the sound generated by Boulder, Colorado, during a typical weekday.

The Contractor shall conduct aerial monitoring in Boulder, Colorado, at as many of the sites identified under Task 1 as can be monitored in compliance with the then-existing regulations of the Federal Aviation Administration (FAA). This monitoring shall be between the effective date of this Modification No. 1 and April 15, 1978, and shall be of sufficient duration to characterize the noise environment during the entire period from sunrise to sunset at each site.

If the aerial package does not operate because the batteries fail to operate due to low temperature the measurement lost during any day shall be repeated by the Contractor. Monitoring shall be in compliance with FAA Regulation 101. Data gathered shall satisfy the design and performance criteria specified in Phases I and II. Representative analog data of 1 1/2 hour duration shall be taken at each site.

The Contractor shall analyze results, computing for the time periods monitored, cumulative statistics, associated standard deviation, L_h and L_{eq}. Analysis of these data shall be demonstrated making use of chart recorders and also environmental noise classifiers. An approximation of the total sound power produced by sections of Boulder, Colorado, during a representative weekday should be made. Results shall be submitted to the Project Officer.

The Contractor shall conduct aerial monitoring at selected locations in Boulder, Colorado, at a period of time between May 1 and September 20, 1978. Results shall be analyzed, computing for the time periods monitored, cumulative statistices, associated standard deviation, L_h and L_{eq}. Analysis of these data shall be demonstrated making use of chart recorders and also environmental noise classifiers. An approximation of the total sound power produced by sections of Boulder, Colorado, during a representative weekday should be made. Results shall be submitted to the Project Officer.

The Contractor shall fabricate a second aerial instrument package which satisfies the design and performance criteria that are specified herein for the first aerial instrument package.

This requirement is contingent upon the provision by the Government, at Government expense, of a second transmitter that is physically and electrically compatible with other components identical to those in the first aerial instrument package.

PERFORMANCE TESTS

Frequency Response and Dynamic Range

End to end system frequency response and dynamic range was measured by replacing the microphone with an equivalent voltage source. This voltage source level was adjusted to be equal to the microphone open circuit voltage at 120, 100, 80, and 60 dB at 1000 Hz. This input voltage was held constant and the frequency was set to the octave band center frequencies from 20 to 10 KHz. System output was measured at the weighting networks of the telemetry ground station. Thus, these tests include any effects of the RF link. The noise floor was measured with the input grounded and the noise floor measured in octave bands, flat and A weighting. Figures 8 through 11 show the measured data for each full scale sound pressure level range. One additional data point is shown on these figures which is the level above full scale at which the sine wave input becomes distorted when viewed on an oscilloscope. This point is a measure of the crest factor when the input signal is random in nature.

A summary of the results for each full scale sound pressure level range follows:

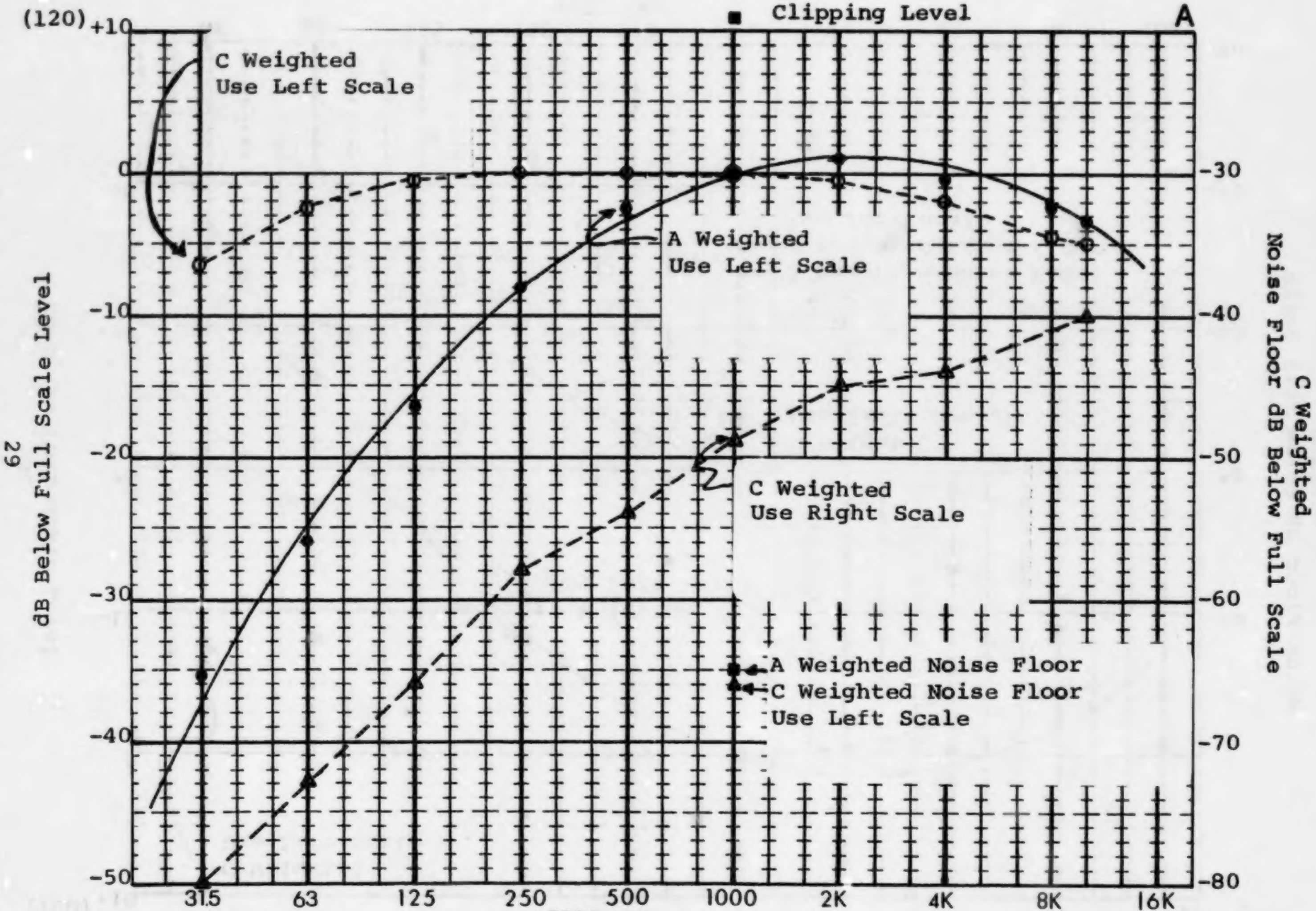
(1) 120 dB Range
    a. Crest Factor - 11 dB
    b. C weighting - Type II
    c. A weighting - Type II
    d. C weighting Noise Floor - 35 dB
    e. A weighting Noise Floor - 36 dB

(2) 100 dB Range
    a. Crest Factor - 14 dB
    b. C weighting - Type II
    c. A weighting - Type II
    d. C weighting Noise Floor - 34 dB
    e. A weighting Noise Floor - 36 dB

(3) 80 dB Range
    a. Crest Factor - 13.5 dB
    b. C weighting - Type II
    c. A weighting - Type II
    d. C weighting Noise Floor - 26 dB
    e. A weighting Noise Floor - 33 dB

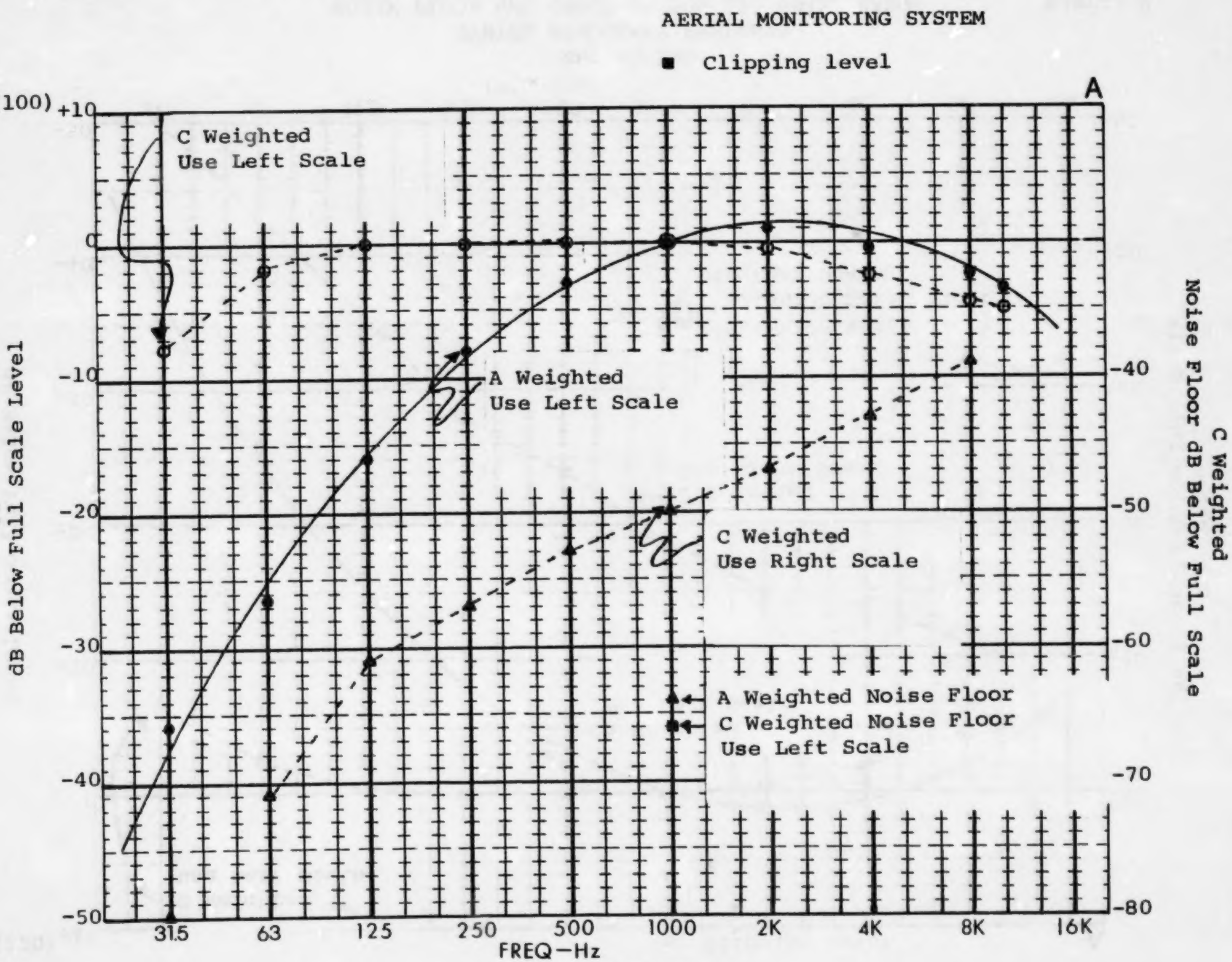
(4) 60 dB Range
    a. Crest Factor - 12 dB

AERIAL MONITORING SYSTEM



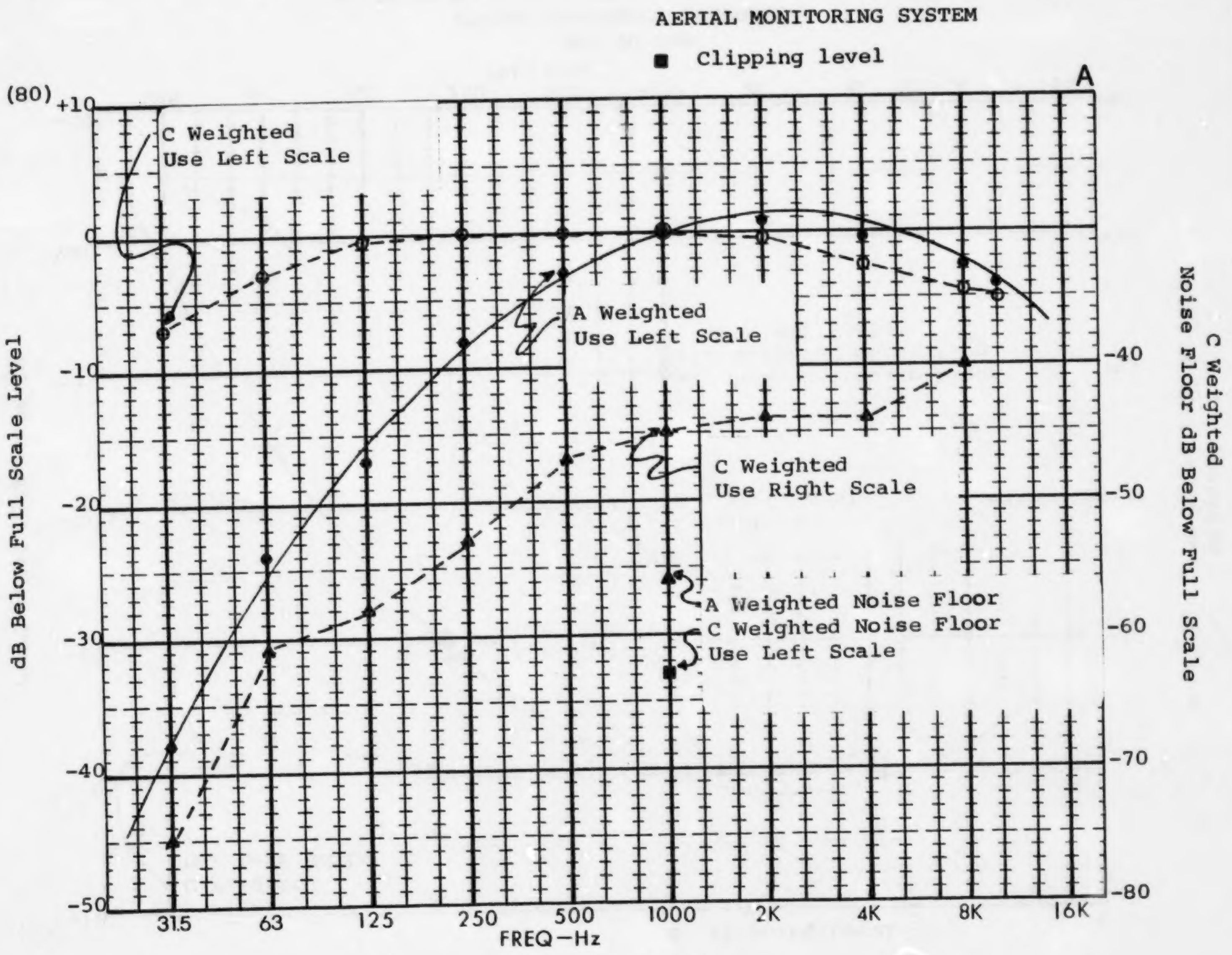
END TO END
SYSTEM FREQUENCY RESPONSE
NOISE FLOOR AND CREST FACTOR 120 dB(A) RANGE

Figure 8



END TO END
SYSTEM FREQUENCY RESPONSE,
NOISE FLOOR AND CREST FACTOR 100 dB(A) RANGE

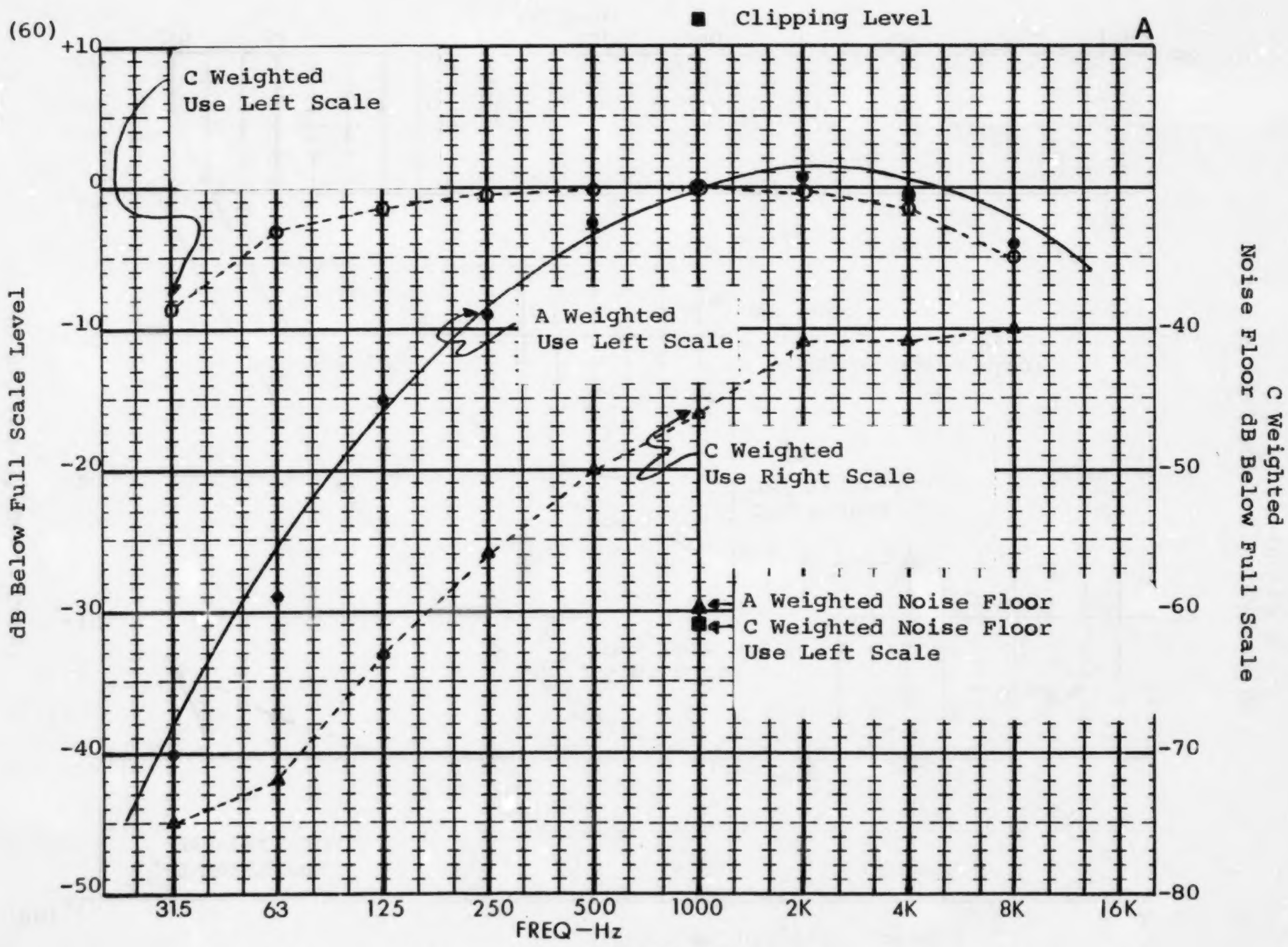
Figure 9



END TO END
SYSTEM FREQUENCY RESPONSE,
NOISE FLOOR AND CREST FACTOR 80 dB(A) RANGE

Figure 10

AERIAL MONITORING SYSTEM



END TO END
SYSTEM FREQUENCY RESPONSE,
NOISE FLOOR AND CREST FACTOR 60 dB(A) RANGE

Figure 11

b. C weighting - Type II
c. A weighting - Type II
d. C weighting Noise Floor - 30 dB
e. A weighting Noise Floor - 31 dB

Accuracy versus Distance

System end-to-end accuracy was verified by applying a known acoustic stimulus to the microphone at various distances. System accuracy is then determined by calibrating the system with the transmitter located a short distance from the receiver, 10 m., and then leaving all calibration adjustment controls on the ground station as is, and then repeating the acoustic stimulus calibration with the transmitter at various distances from the receiver starting at 10 m. The A weighted calibration signals were recorded on a General Radio Type 1521 level recorder with an 80 dB potentiometer. The recorded calibration signals are shown in Figure 12 & 13 and it can be seen that system accuracy and stability is within ± ½ dB.

Comparability Tests

The accuracy and validity of the telemetry system was verified by recording a sample of noise with the telemetry system and with a hardwired system and comparing the amplitude-time history with each other. The telemetry system was positioned 150 m. from the receiver antenna and the A weighted sound level recorded on a Gen Rad 1521 level recorder. A Gen Rad 1933 sound level meter was placed very close to the aerial telemetry system and the output of the sound level meter recorded on a Gen Ran 1521 level recorder. Both level recorders were adjusted to have damping overshoot and creep matched as close as possible by applying an electrical signal to their inputs which stimulated typical acoustical time histories.

These two records are shown in Figure 14 and it can be seen that the two signals track each other very well. The small differences are due to differences in the graphic level recorders.

Flyability and Windscreen Evaluation

During the month of March, 1978, performance tests were conducted at the NCAR test facility located south of Boulder. These tests were primarily conducted to determine system signal to noise ratio and accuracy under various operating conditions. One of the tests performed was to determine the effectiveness of the

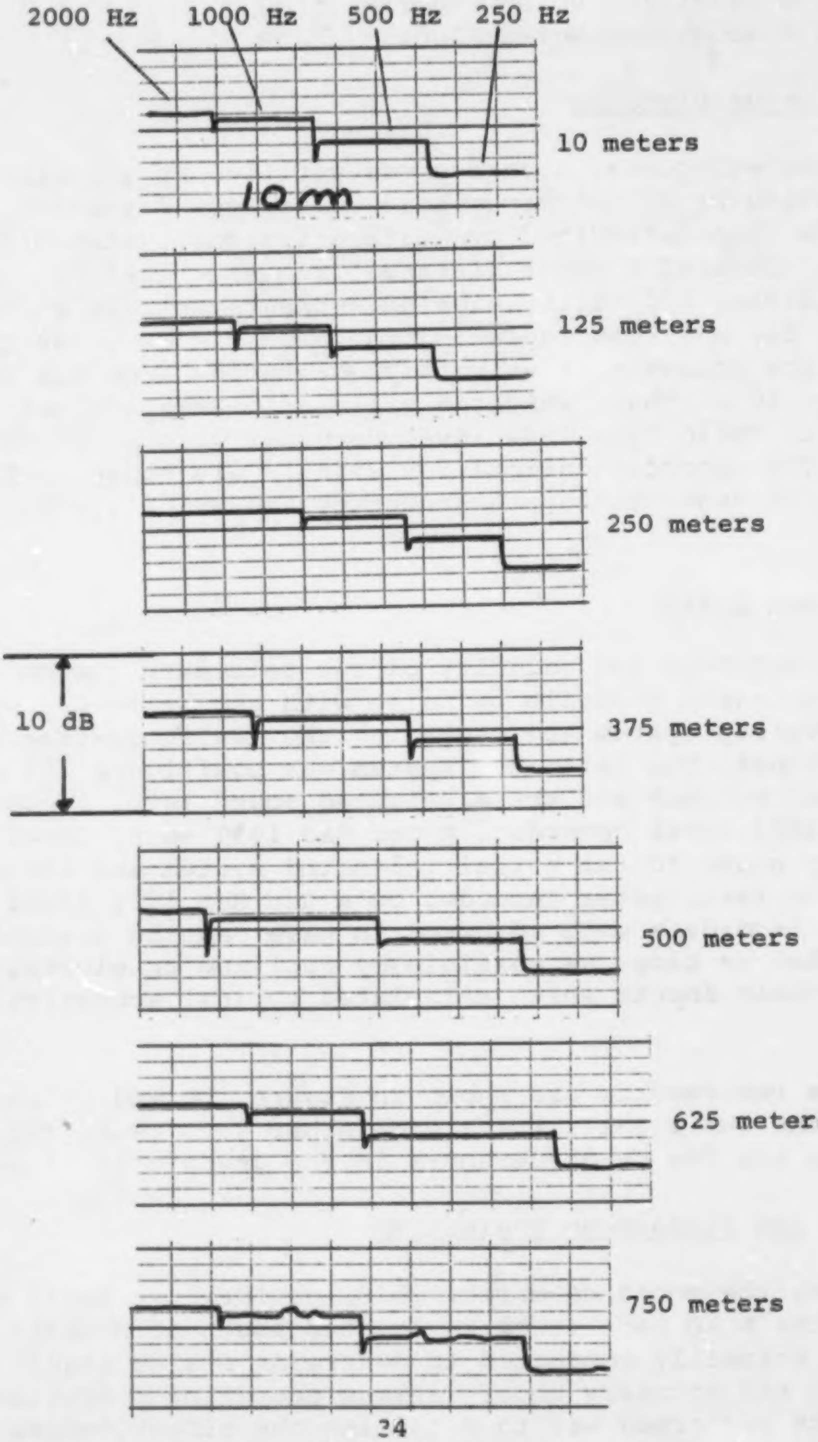

2000 Hz
1000 Hz
500 Hz
250 Hz
10 meters
10m
125 meters
250 meters
10 dB
375 meters
500 meters
625 meters
750 meters

Figure 12

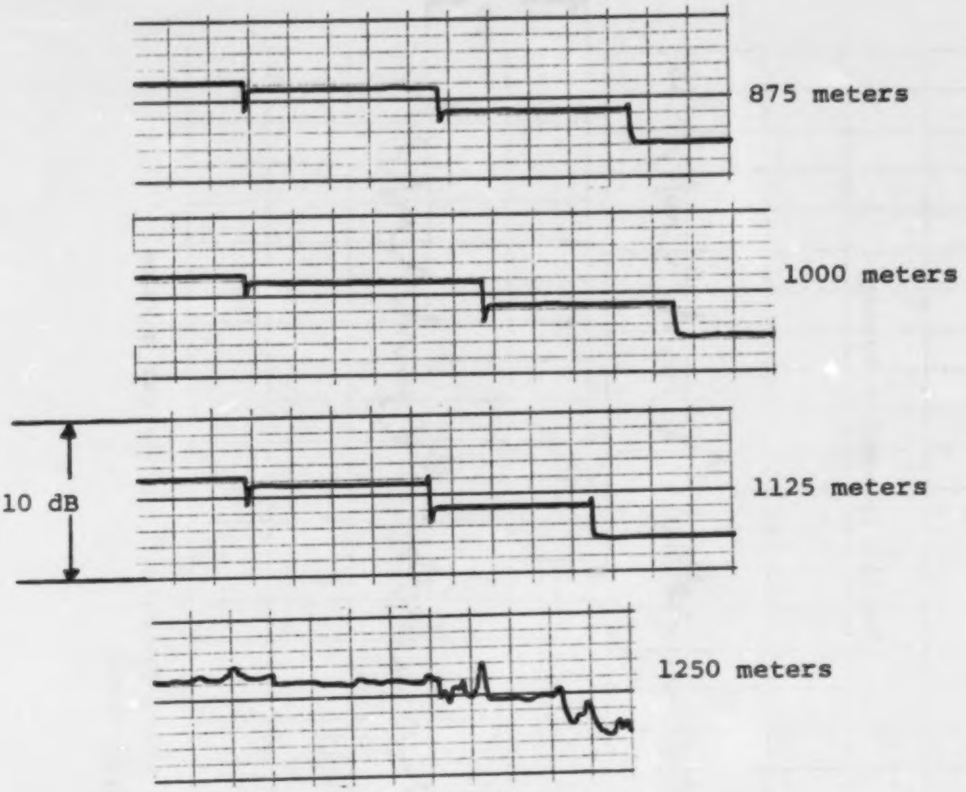


Figure 13

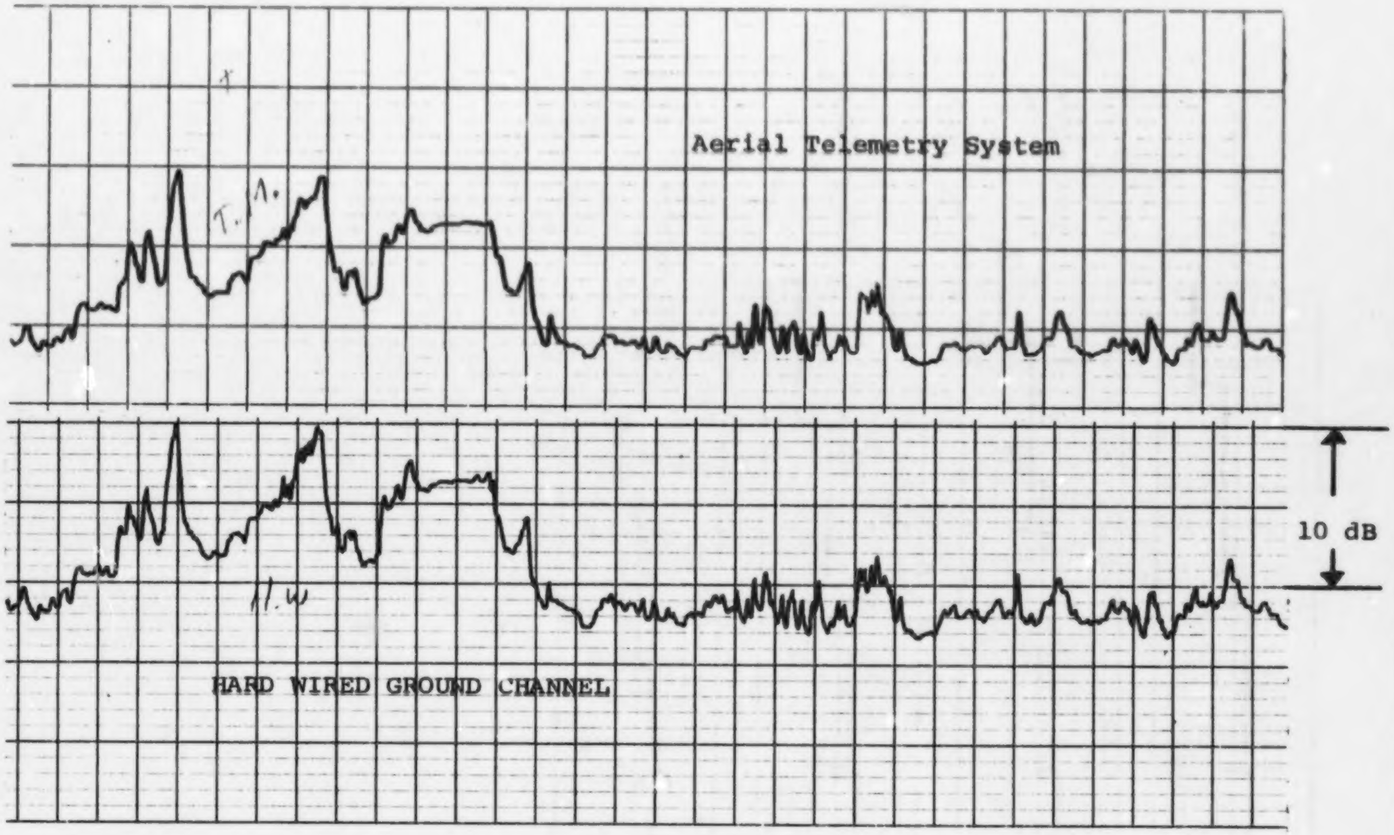


Chart Speed 2.5 inches per minute

COMPARABILITY TESTS

Figure 14

wind screen by towing the balloon and transmitter behind a vehicle. It was observed first that the stability of the balloon degrades at speeds greater than 24 km/h and secondly, the road noise produced by the tires of the vehicle even at low speeds was greater than 30 dB(A). It was observed from flight data that the present wind screen design will allow the acquisition of data up to wind speeds of 24 km/h, which is the stability limit for the system. The balloon will fly at greater speeds, as great as 48 km/h, but the balloon will oscillate and the transmitter package flails around and impact noise is generated. With the circularly polarized receiving antenna the balloon can be as much as 45 degrees from the vertical at altitudes of 152 m.

During the winter measurements conducted at Boulder in 1978 the tether line was severed and the balloon drifted away. It was found the next day near Greeley, Colorado, about 48 km from Boulder, where it had crash landed in a field. The only damage sustained was several small punctures of the balloon itself; the transmitter package was undamaged. This unplanned event served to demonstrate the durability of the aerial package.

A unique windscreen was developed for the aerial package microphone. Wind noise or pseudosound is produced by turbulence acting upon the pressure sensing element of the microphone. The scale or physical size of the turbulence is a function of the physical configuration of the microphone; its orientation with respect to the flow and flow velocity.

A windscreen serves to reduce the airflow velocity at the microphone. However, the windscreen must perform two functions that are in conflict; that is, it must reduce the velocity at the microphone and at the same time be acoustically transparent.

To accomplish this the microphone is surrounded by a porous barrier which slows the flow velocity. This can be accomplished by a fine mesh such as cloth. Unfortunately, the reduction of flow velocity achieved by the porous material also produces turbulence which can be transduced by the microphone. The solution to the problem is to select a mesh size such that the turbulence has decayed to an acceptably small value by the time it reaches the microphone. The use of concentric windscreens affords a greater reduction in flow velocity and the second or interior windscreen washes out the turbulence produced by the first windscreen. A further improvement can be achieved by making the first windscreen teardrop in shape which has a lower aerodynamic drag than a spherical windscreen.

Although this double enclosure design provides considerable reduction in wind noise, the establishment of a finite relationship between windspeed and the lower limit of useful data is complex because of variability in data noise spectrum as it relates to the windnoise.

Experience in actual operation of the aerial package in Boulder during the winter and summer months has shown the most effective way to determine when the wind is affecting the data is to listen to the linear output of the receiving station thru a pair of high quality headphones.

Laboratory Tests

Wind tolerance was determined by swinging the telemetry package on a 4.6m line suspended from a 6.2m high acrobats practice rigging. The package was lifted along its path until it was 4.6m above its initial position and released so that it could swing freely to and fro as a pendulum. The velocity at the bottom of the first swing is about 9.49m/sec and reduces in value with each successive swing. The "C" weighted output of the ground station was fed to the octave band analyzer of a Gen Rad 1933 and then plotted on a graphic level recorder. The tests were run at drop heights of 4.6 and 1.52m and with the wind screen on and off. The reduction in wind noise with the wind screen on especially at 9.49m/sec is very dramatic when the analog signal is listened to over a loudspeaker. Figure 15 shows the wind noise measured at 9.49 and 5.46m per second with and without the windscreen and with the telemetry system set at 60dB full scale. The results of the tests show that at 9.49m per second the noise floor is equal to about 63 dB(A) and 56 dB(A) with the wind screen on and off respectively. At 5.46m per second the noise floor is 54 dB and with the windscreen off and at most 47 dB with the windscreen on. Lower values with the windscreen on at 5.46m per second were not measurable because of the ambient noise level at the measurement site.

Harmonic Distortion Tests

Harmonic distortion tests were conducted by the Electronic Service Co., 865 Orman Drive, Boulder, Colorado. The tests showed the aerial package to be within specification. A copy of the test report certified by Mr. H. E. McKenna of Electronic Service Co. is presented on the following page. In addition to these tests the following test was conducted by EDI: A 1KHz signal was applied at the microphone connector correspinding to full

H. E. "Ed" McKenna
ELECTRONIC SERVICE
865 Orman Drive
Boulder, Colorado
80303

To:
Engineering Dynamics,Inc.
6651 South Wellington
Littleton, Colorado 80121

DATE 31 July 1976

INSTRUMENT CERTIFICATION:

This is to certify that the material listed below has been tested on the date shown and has been found to be within the limits and tolerance indicated in the instrument's published specifications.

Working Standards used for calibration are determined and maintained in terms of reference standards periodically certified and traceable to the National Bureau of Standards.

INSTRUMENT MFG.	TYPE	DEVICE	S / N	CALIBRATION TECHNIQUE
Engineering Dynamics,Inc	Prototype Aerial	PROTOTYPE Monitoring Package	1	ANSI S1.4-1971 Type 2
	Internal Noise and Distortion(Dynamic Range)			Worst Case Condition 70 dB on 60 dB Range

Distortion "C" Wt Network 1.9% at 1000 Hz

Distortion "A" Wt Network 1.8% at 1000 Hz

Internal Noise Worst Case Inst. Package set 60 dB = 0.04 mv
" 70 dB Full Scale = 0.125 mv

SPECIAL NOTE: REF. EPA SUPPLIED MICRODYNE CORP. MODEL 1100 AR RECEIVER
Distortion to be less than 3%
page 5-13 para. 5-24-B12
Full tests should be carried out on all sections of Aerial package to determine each section's distortion.
* At this time I feel that the majority of the distortion in the system is coming from the MicroDyne Receiver.

Hugh E. McKenna
Hugh E. McKenna

"Precision without accuracy is meaningless. Accuracy must be renewed periodically by means of certified calibrations."

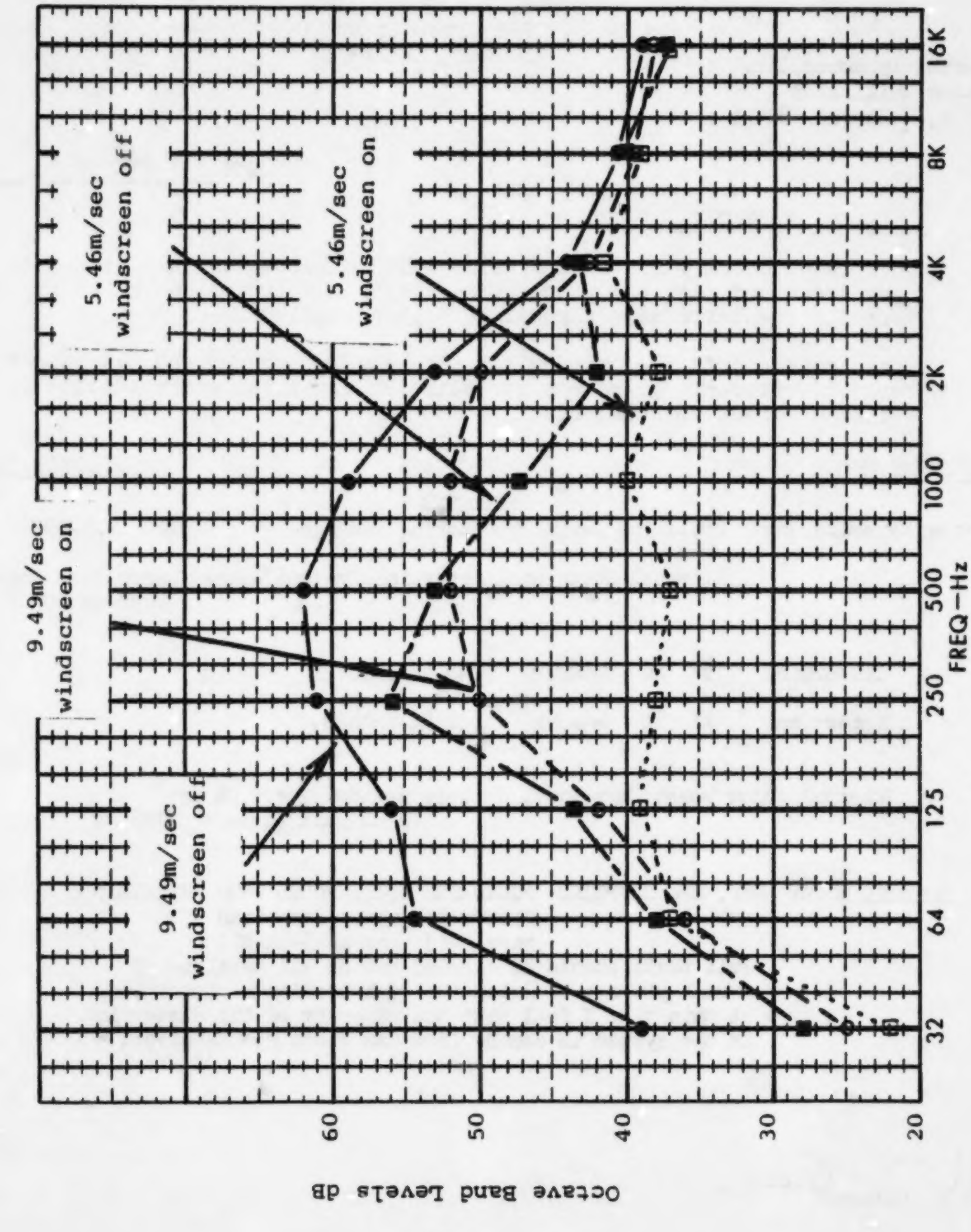


Figure 15

Windnoise Tests

scale for each sound level range. At these levels the following 2nd harmonic levels were measured at 2KHz.

SPL Range	1KHz Level	2KHz Level	% 2nd Distortion
110	110	-39dB	1.12%
90	90	-42dB	0.79%
70	70	-39dB	1.12%
50	50	-35dB	1.78%

Temperature Tests

In July of 1976 temperature tests were conducted with the aerial package mounted in an altitude chamber such that the microphone was sticking out of the chamber so that the acoustic calibrator could be connected to the microphone. Figures 16 through 18 show the system frequency response at several temperatures. The lowest temperature achievable in the chamber during these tests was -10°C and therefore it was not possible to test at the -15° as specified in the contract. It was noted, however, that the mercury batteries dropped about 2 volts at -10°C. A 2 volt drop per battery would be significant if the battery pack was nearing depletion and the battery voltage was about 14 volts. Then a 2 volt drop would bring the regulated power supply to below 12 volts and the subcarrier VCO would exhibit excessive drift. It was later discovered that the mercury batteries decreased severly in voltage at -15°C and that operation of the aerial package at this temperature was not possible. Operation to temperatures as low as -20°C can be achieved if lithium batteries are used.

Microphone Performance

The microphone used with the aerial package is a GenRad Model 1971 one inch ceramic microphone. The ceramic microphone was selected because of its resistance to high humidity; the microphone will operate at 100% RH with slight condensation for extended periods of time without a change in calibration. The attached data sheet shows the specifications for the Model 1971.

Accuracy Tests - Flying Calibrator

On March 23, 1977, a G.R. Model 1562-A Sound Level Calibrator was attached to the G.R. Model 1560-9570 1 inch diameter mi-

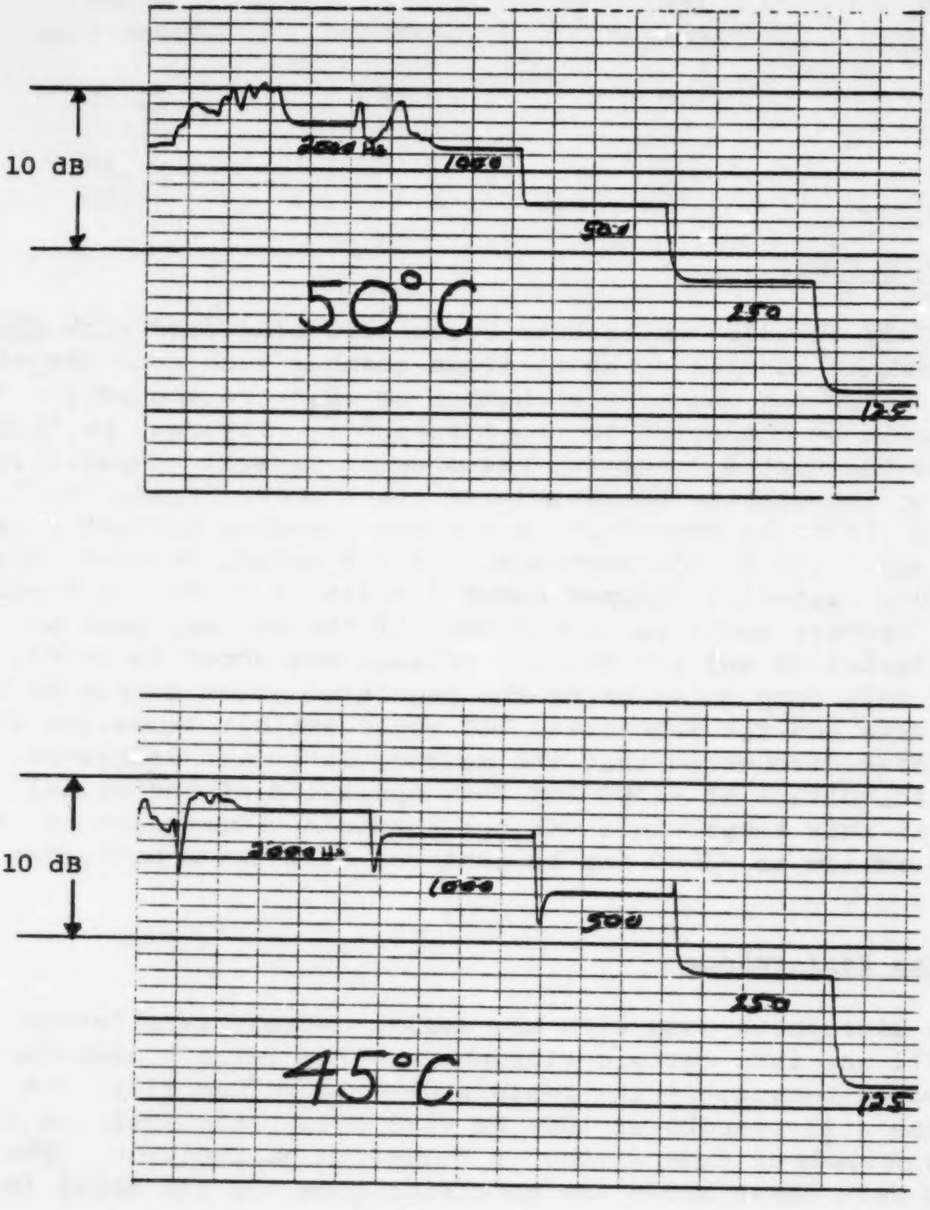

10 dB
2000 Hz
1000
500
250
125
50°C
10 dB
2000 Hz
1000
500
250
125
45°C

Figure 16

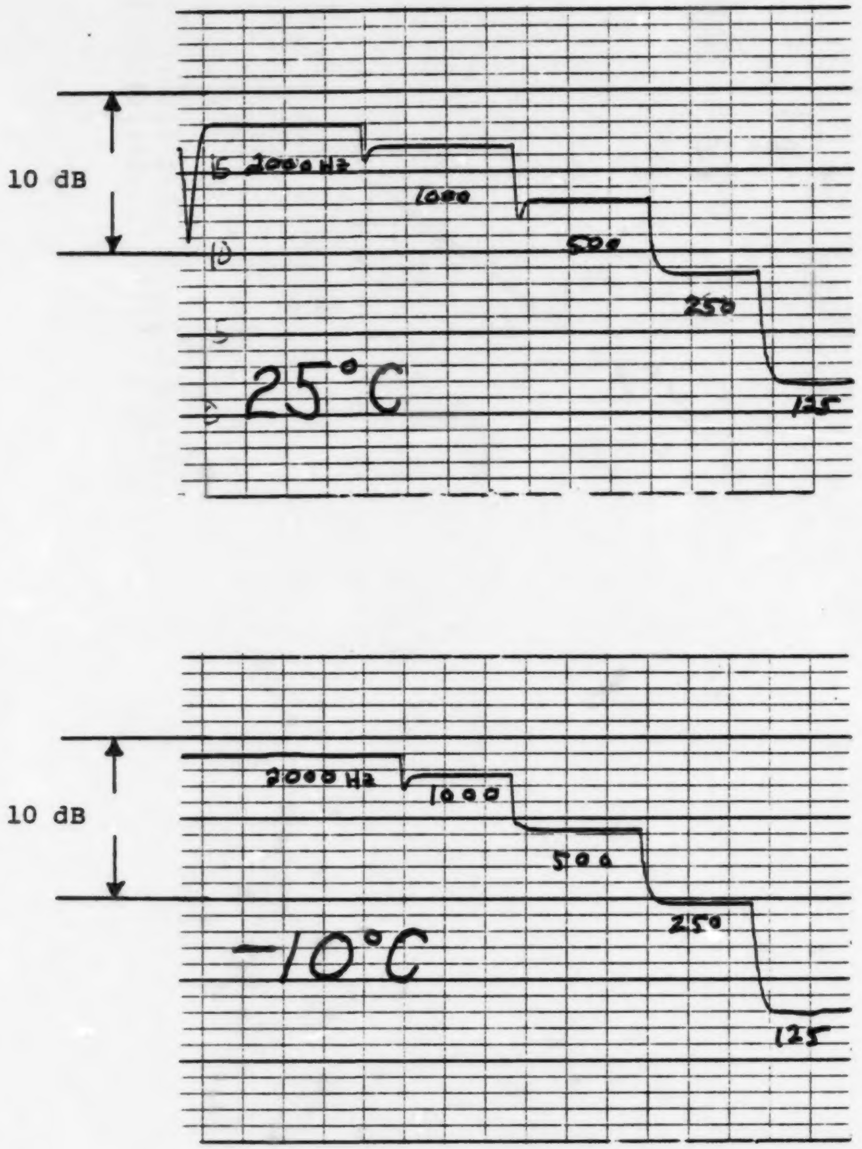

10 dB
15
2000 Hz
1000
500
10
250
5
125
0
25°C
10 dB
2000 Hz
1000
500
250
-10°C
125

Figure 17.

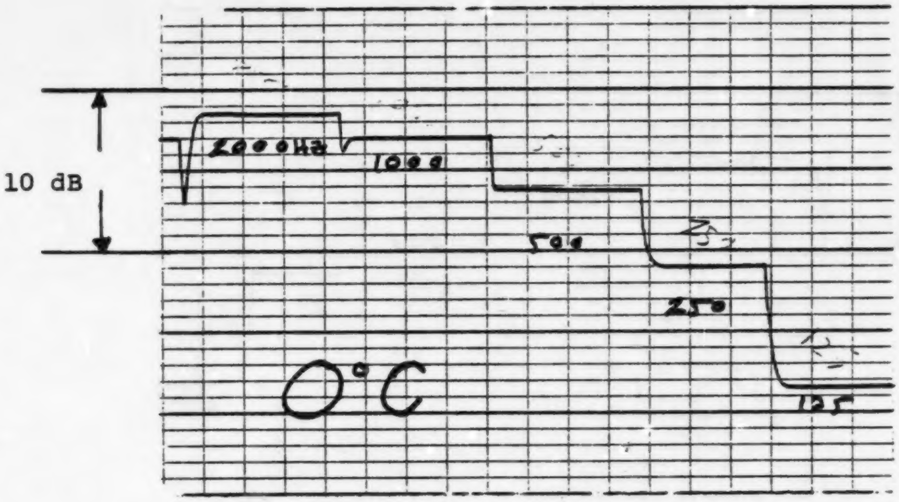


Figure 18

Specifications

1971-9601 1-INCH CERAMIC MICROPHONE, 1971-9605 1-INCH CERAMIC MICROPHONE (1560-P5) and 1971-9606 MICROPHONE ASSEMBLY (1560-P6).

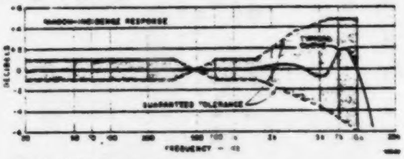
Frequency: Curve shows typical response and guaranteed limits; individual response curve supplied with each microphone. Below 20 Hz, the microphone is typically flat ±1 dB down to 5 Hz. Time constant of pressure-equalizing leak is typically 0.08 s.

Sensitivity Level: NOMINAL: −40 dB re 1 V/N/m² (−60 dB re 1 V/μbar); MINIMUM: −42 dB re 1 V/N/m² (−62 dB re 1 V/μbar). TEMPERATURE COEFFICIENT: ≈ −0.01 dB/°C. KEY SOUND-PRESSURE LEVELS: <1% distortion at 150 dB; at −184 and +174 dB peak, microphone may fail.

Impedance: For 1560-9605 and −9570, 385 pF ±15% at 23°C; for 1560-9606, 405 pF ±15% at 23°C. TEMPERATURE COEFFICIENT of Z, for both: 2.2 pF/°C from 0 to 50°C.

Environment: TEMPERATURE: −40 to +60°C operating. HUMIDITY: 0 to 100% RH operating.

Mechanical: TERMINALS, 3-pin mike connector; microphone cartridge has two terminals plus the shell; both terminals can be floated with respect to ground. DIMENSIONS: Cartridge only, 1.13 in. (29 mm) long, 0.936 ± .002 in. (23.7 mm ± 50 μm) dia: 1560-P5 assembly, 2.31 in. (59 mm) long, 0.94 in. (24 mm) dia; 1560-P6 assembly, 11.75 in. (298 mm) long, 0.94 in. (24 mm) dia. WEIGHT: 1560-P5, 0.2 lb (0.1 kg) net, 1 lb (0.5 kg) shipping; 1560-P6, 0.7 lb (0.3 kg) net, 2 lb (0.9 kg) shipping.



Typical performance
with the 1560-P42 and 1972-9600 Preamplifiers (Unity Gain)

Frequency Range	System Sensitivity re 1 V/N/m²	Dynamic Range* re 20 μN/m²
5 Hz to 12.5 kHz	−40 dB	22 to 145 dB

* A-weighted noise level to maximum rms sinewave signal without clipping.

Figure 19

crophone of the aerial monitoring package. The output signal from the FM receiver was fed to a Gen Rad 1933 Sound Level Meter. The electrical output of the "A" weighting circuit of the demodulator of the GR 1933 produced a reading of 105 dB which corresponds to an actual sound pressure level of 112.82 dB at 1000 Hz. The system was then flown to an altitude of 457 m. in increasing increments and the sound pressure level produced by the calibrator measured as shown below. The GR 1933 was read to the nearest 0.5 dB.

The equation for the altitude correction to the calibrator is as follows:

$$\text{dB} = 114.4 - 0.914 \times 10^{-3}\ H$$

where H is the altitude in meters above sea level.

Flying Calibrator
Test Results

Altitude (meters)				
Above Ground Level	Above Sea Level	Calibrator Levels	Sound Level at Receiver	Change dB
0	1605.9	112.93	112.93	0
39.6	1645.6	112.89	112.85	-0.04
60.9	1666.9	112.87	112.76	-0.11
121.9	1727.9	112.82	112.70	-0.12
243.8	1849.8	112.71	112.47	-0.24
335.3	1941.3	112.62	112.29	-0.33
457.2	2063.2	112.51	112.06	-0.45

It can be seen in the above table that the change is 0.45 dB or ± 0.225 dB about the mean of -0.225 dB, which is within the ± 0.5 dB specified.

Additional tests were conducted using a noise source on the ground which consisted of a random noise source driving a 50 watt loudspeaker. The results were not acceptable because the transmitter path through the air was not constant due to turbulence and velocity gradients. The sound level did decrease with altitude but the statistical variations were in excess of ± 2 dB at 61 m., and progressively greater at greater altitudes.

The statistical variations may have been smaller if a more intense noise source had been used.

Signal to Noise Ratio

On March 23, 1977, tests were conducted to determine the system signal to noise ratio as a function of altitude with all other environmental factors present such as: wind gusts, temperature variations, and changes in antenna alignment. The A weighted output of the ground station system was connected to a General Radio sound level meter. This is a precision instrument and the meter can be read to about 0.25 dB. The test site elevation was 1606 meters above sea level and at this altitude the sound level produced by the G.R. 1562A calibrator is 112.82 dB at 1000 Hz. When this calibration signal was applied to the aerial package microphone the G.R. 1933 sound level meter read 105 dB. The aerial package range selector was set to the 130 dB position when this calibration signal was applied. To further reduce the acoustic sensitivity of the package the one inch microphone was removed and a half inch microphone with a 10 dB attenuator was installed which made the full scale level about 143 dB(A). This set-up would allow the measurement of the system noise floor without being affected by actual acoustic input to the microphone. Results of the test are as follows:

Altitude Meters	Sound Level dB(A) Slow
0	57.18
40	60.18
61	60.18
122	53.18
244	61.18

These data show a signal to noise ratio of much greater than 50 dB. But it should be noted that these levels were the minimum levels observed on the meter and that there were fluctuations which exceeded these levels. Thus, the next logical test was to connect the ouput of the ground station to the Gen Rad 1945 Community Noise Analyzer and collect data for ½ hour intervals at various altitudes. Again the system was set to the 90 to 130 dB(A) range with the ½ inch microphone and 10 dB attenuator to reduce the influence of actual noise upon the system. Measured sound levels less than 97.82 dB(A) correspond to noise from more than 40 dB below full scale. Several altitude traverses were made and the results from the additional testing are as follows:

Altitude (meters)
90 - 130 dB(A) Range

Exceedance Level	457	244	122	457	457	244	122	61	30
Max.	94	110	73	98	93	100	120	120	120
.1	89	104	72	90	89	96	120	120	120
1	73	74	70	73	72	82	87	71	120
5	72	70	70	71	69	73	71	68	63
10	72	69	70	71	68	70	68	64	62
20	72	69	69	71	63	66	63	62	62
50	72	69	69	71	63	63	61	61	61
90	40	58	53	68	62	61	60	60	60
99	39	52	53	39	62	61	60	60	59
Min.	38	51	52	39	62	61	60	60	59
Eq	71	79	68	72	66	72	98	95	101

Of the 9 tests, 2 failed to produce an L_{eq} value equal to or less than a signal to noise ratio of 40 dB. At this point the test program was stopped and the reason for the poor signal to noise ratio investigated. Two possible causes were found:

1. The antenna lead inside of the aerial package was broken. One could speculate that this occurred during the 121.9 m test, second run, because all data after that test was not acceptable.

2. The combination of a dipole transmitting and a dipole receiving antenna can result in minimum signal strength when the antenna are aligned orthogonally. A very simple solution to the problem was discovered by replacing the dipole receiving antenna with a circularly polarized antenna.

The antenna lead was repaired and a circularized receiving antenna was installed. The tests were repeated in April and the system performance was measured as follows:

Altitude (meters)
90 - 130 dB(A) Range

Exceedance Level	30	61	122	244	457	244	122	61	30
Max.	75	77	79	77	91	83	81	78	76
.1	74	75	77	76	89	80	79	76	74
1	73	74	75	73	73	75	74	75	73
5	72	73	72	71	70	72	71	73	71
10	71	72	71	71	67	69	70	70	70
20	70	71	69	70	65	65	66	67	69
50	70	70	69	69	63	60	61	65	68
90	69	68	65	69	61	60	59	61	65
99	63	65	63	63	61	59	57	60	60
Min.	52	53	58	57	60	55	56	54	55
Eq	68	69	69	69	66	65	66	67	68

Operability

During the development tests and the actual monitoring of noise over Boulder in the winter and summer EDI used parttime employees who had no previous experience in operating the aerial monitoring system. After a 4 hour training period these persons were able to operate the system. A list of all personnel who have operated the system including their approximate ages and training follows:

Name	Approximate Age	Experience Level
H. McGregor	48	High
R. Chanaud	45	High
S. Rossi	27	High
T. Fenner	25	Low
D. Miller	22	Low
N. Ott	16	Low
G. Simmons	27	Low
S. McGregor	22	Low
D. Boettcher	22	Low
R. Black	22	Low
R. Dolan	24	Low
A. Griffith	24	Low

The following public employees and other non-EDI employees also operated the system but not for extended periods of time:

J. Adams	Noise Control Officer, Boulder
R. Simmons	U.S. EPA, Region VIII
H. McKenna	University of Colorado, Boulder

During conduct of the program these operational factors were observed:

1. There must be two trained operators on site at all times when the balloon is being flown. The reason for this requirement is that in the event of minor problems in handling the balloon two people are required. Three operators should be present when the balloon is being flown and there are nearby thunder storms.

2. The balloon line must be inspected by running the line out over the operator's hand so that knots or nicks in the line can be detected.

3. The balloon line must be non-conductive.

4. The high pressure helium tanks must be handled and transported with care. Tanks must not be stored upright since they can tip over and inflict serious injury.

5. Extension cords used to provide the 120 v AC power to the ground equipment must be of adequate capacity and secured. The momentary loss of power will result in the complete loss of data when a statistical analyzer is being used. A power loss inhibit signal can be used to correct this problem for certain statistical analyzers.

6. If the power source used does not have provisions for a third wire ground one must be provided by the operators of the aerial monitoring system to insure the safety of the equipment and personnel. This can be accomplished by driving a .60 to .90 m metal stake into the earth and using the stake for the required ground path.

SECTION 6

AERIAL MONITORING TESTS

SITE SELECTION

The City of Boulder, Colorado, was selected for the test site because the city has an active noise control program and was one of the first communities to have a noise ordinance. Also, it was near the mountains just west of the city that Dr. Robert C. Chanaud and R. A. Simmons conceived the idea of aerial noise monitoring. It should be pointed out that this entire project is one of an exploratory nature and in the beginning it was not known if the aerial monitoring technique was practical. Considerable effort was spent by U.S. EPA, Region VIII, in preliminary testing using a Gen Rad 1965 sound level meter strapped to a metal box containing the transmitter and battery pack. These early efforts were fraught with unforseen technical problems such as equipment malfunctions, poor signal to noise ratio, signal drop-out, and inadequate receiver sensitivity. However, sufficient data was collected to demonstrate the feasibility of this aerial noise monitoring technique.

The U.S. EPA, Region VIII, awarded a development contract to Engineering Dynamics, Inc. to produce an airborne noise measurement system including a ground station. As part of the program personnel monitoring was to be investigated and conducted if there was equipment available to perform this task. Subsequent research revealed that personnel monitoring was a much greater task than first estimated and work on this concept was deleted from the program.

It was decided to conduct the aerial monitoring during a quiet and noisy season in the City of Boulder. Observations around Boulder revealed that the summer is the noisiest season and the winter the quietest, with the difference in noise levels caused, for the most part, by motorcycles and barking dogs.

Ten sites were selected that were uniformly spaced about the city and would allow total integration of the noise produced by Boulder. These sites were selected on the assumption that the balloon could be flown as high as required, up to 760 meters.

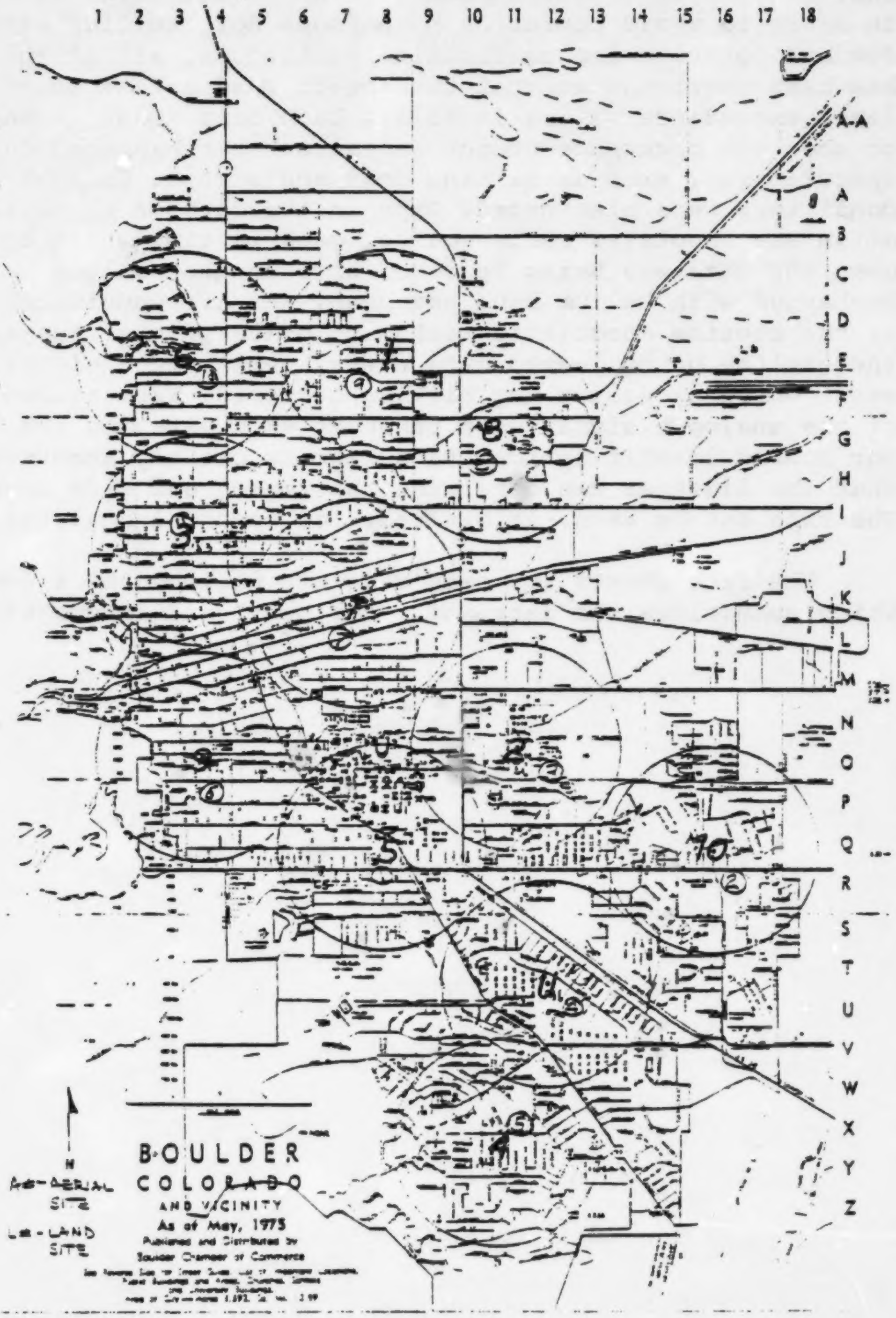
The site location map which shows the sites selected for monitoring follows as Figure 19 . A brief description of each site follows:

Site No.	Location
1	2535 Meadow Avenue
2	Scott Carpenter Park near 30th Street and Arapahoe Avenue
3	North Boulder Park near 9th Street and Balsam Avenue.
4	1210 Hartford Drive (April) 1285 Georgetown Road (July)
5	University of Colorado campus near 28th Street and Baseline Avenue
6	Near Maxwell Lake, north of Linden Avenue, west of Broadway
7	Whittier School near 21rst Street and Spruce Avenue
8	Omitted
9	1000 Rose Hill Drive
10	Baseline Avenue and Foothills Parkway
11	Martin Park near 39th Street and Martin Drive (This was referred to as No. 4 on the log sheet)

MEASUREMENT RESULTS

The data sheets which follow show the exceedance levels measured at 152 m. above each site during two measurement intervals, ie., the quiet and noisy seasons. The original data sheets which have been retained in the EDI archives were recorded such that a level of 93 corresponded to an actual level of 70 dB(A). In order to avoid confusion by persons not familiar with the decibel notation and calibration techniques, all of the data has been corrected so that the sheets read actual sound pressure level exceedance values in dB(A). Each data sheet is annotated to show the occurance of any anomalies that happened during the specific run, such as barking dogs and sirens. Unusual weather conditions were also noted. Gaps in the data of significant duration are annotated while smaller gaps in time which occurred when the data was being recorded or when the balloon was being recharged with helium have not been, and are considered part of the routine associated with such measurements. In general, the quality of collected data was extremely good except for those sites where excessive dog barking occurred. Tape recordings of the analogue signal were taken at each site and can be used for source identification. Each tape is clearly annotated so that the listener can determine the season and site location. The tape can be used, if desired, for spectral analysis.

The data sheets for each site are prefaced by a cover sheet which summarizes the data and other pertinent information.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T
U
V
W
X
Y
Z
N
A-AERIAL SITE
L-LAND SITE
BOULDER
COLORADO
AND VICINITY
As of May, 1975
Published and Distributed by
Boulder Chamber of Commerce

Figure 19

Site 1

Site 1 was located at 2535 Meadow Avenue. The area is residential with no nearby commercial activities. Meadow Avenue is a narrow residential street and because of this traffic speed and volume is restricted. The site is on the north end of Boulder and free from the noise intrusions caused by University of Colorado students operating motorbikes, motorcycles and cars with inadequate mufflers as is typical at the south end of the city where the campus is located. Site 1, however, is in line with the Boulder Airport and some of the data includes the effects of aircraft noise. A summary of the test sequence follows:

SITE 1

Date	Run No.	Time	Duration
3-29-78	1	07:11-08:11	1
3-29-78	2	08:11-09:11	1
3-29-78	3	09:11-10:11	1
3-29-78	4	10:25-11:25	1
3-29-78	5	12:42-13:42	1
3-29-78	6	13:43-14:43	1
3-29-78	7	14:57-15:57	1
3-29-78	8	17:10-18:10	1
3-29-78	9	18:23-18:53	½
7-17-78	1	05:32-06:32	1
7-17-78	2	06:33-07:33	1
7-17-78	3	07:35-08:35	1
7-17-78	4	08:37-09:37	1
7-17-78	5	10:21-11:21	1
7-17-78	6	11:50-12:50	1
7-17-78	7	12:55-13:55	1
7-17-78	8	16:18-17:18	1
7-17-78	9	17:30-18:30	1
8- 1-78	10	12:32-13:32	1

Job No.______
Date: 3-29-78
Sheet 1 of 3

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	1	2	3
	Dur.Hrs.	1.0	1.0	1.0
	From	7:11	8:11	9:11
	To	8:11	9:11	10:11
	L Value	☒	☒	☒
Switch Up	Max	63	60	79
	.1	61	58	74
	1	59	57	59
	10	55	54	55
	50	53	53	52
	90	52	51	51
	99	51	50	50
	Min	51	49	49
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	58	56	57
	5	56	55	56
	20	54	54	54
	Eq	54	53	54
	Dn			

Check List

Bat Test	
1st Run	
2nd Run	
3rd Run	
Mic/Aux	Aux.
Weighting	A
Fast Slow	Slow
Data Erase	
Cal.	94=70dB
Altitude	152 m
Set Time	
Clock Starts	
Start Clock	
Set Time Run	
Begins	
Enable Run	
Display Off	
Time Left Site	

By:______

Remarks 1

Remarks 3 9:45 airplane flew extremely close to package.

Remarks 2

Calibrator
Cal. Level
Freq.

Site Location:
Bill Bryan's house, Meadow and Folsom

Site Map on Back of Sheet

Job No.______

Date: 3-29-78

Sheet 2 of 3

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	4	5	6
	Dur.Hrs.	1.0	1.0	1.0
	From	10:25	12:42	13:43
	To	11:25	13:42	14:43
	L Value	☒	☒	☒
Switch Up	Max	69	61	59
	.1	66	58	58
	1	61	56	57
	10	56	53	54
	50	54	51	52
	90	51	50	49
	99	50	49	48
	Min	50	48	46
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	60	55	56
	5	57	54	54
	20	55	52	53
	Eq	54	52	52
	Dn			

Check List

Bat Test ☐
1st Run ☐
2nd Run ☐
3rd Run ☐
Mic/Aux ☐
Weighting ☐
Fast Slow ☐
Data Erase ☐
Cal. ☐
Altitude ☐
Set Time
Clock Starts ☐
Start Clock
Set Time Run ☐
Begins ☐
Enable Run ☐
Display Off ☐
Time Left Site ☐

By:______

Remarks 1

Remarks 3

Remarks 2

new batteries

Calibrator

Cal. Level

Freq.

Site Location:

Site Map on Back of Sheet

Job No.
Date: 3-29-78
Sheet 3 of 3

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	7	8	9
	Dur.Hrs.	1.0	1.0	.5
	From	14.57	17.10	18.23
	To	15.57	18.10	18.53
	L Value			
Switch Up	Max	64	74	58
	.1	63	64	57
	1	57	57	55
	10	54	53	52
	50	52	52	51
	90	50	50	50
	99	49	49	49
	Min	48	35	48
Switch Down	.5/24	56	55	54
	1/24	55	54	54
	8/24	52	52	51
	.5/8	50	54	53
	2	56	55	54
	5	55	54	53
	20	53	53	52
	Eq	52	52	51
	Dn			

Check List

Bat Test	
1st Run	
2nd Run	
3rd Run	
Mic/Aux	Aux.
Weighting	A
Fast Slow	Slow
Data Erase	
Cal.	94 = 70 dB
Altitude	152 m
Set Time	
Clock Starts	
Start Clock	
Set Time Run	
Begins	
Enable Run	
Display Off	
Time Left Site	

By:

Remarks 1 15:50 next door neigbor using power mulcher

Remarks 3

Remarks 2 Airplane

Calibrator
Cal. Level
Freq.

Site Location: Site A1 Bill Bryan's house, Meadow and Folsom

Next door neigbor running mulcher 16:50
mulcher stops 17:03

Site Map on Back of Sheet

Job No.
Date: 7-17-78
Sheet 1 of 3

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	1	2	3
	Dur.Hrs.	1.0	1.0	1.0
	From	5:32	6:33	8:35
	To	6:32	7:33	9:35
	L Value			
	Max	71	68	73
	.1	70	67	67
	1	60	58	62
Switch Up	10	51	54	55
	50	47	52	54
	90	45	50	52
	99	43	49	51
	Min	42	47	51
	.5/24			
	1/24			
	8/24			
Switch Down	.5/8			
	2	55	57	59
	5	52	55	57
	20	49	54	55
	Eq	50	53	55
	Dn			

Check List

Bat Test ☐
1st Run ☐
2nd Run ☐
3rd Run ☐
Mic/Aux ☐
Weighting ☐
Fast Slow ☐
Data Erase ☐
Cal. ☐
Altitude ☐
Set Time
Clock Starts ☐
Start Clock
Set Time Run ☐
Begins ☐
Enable Run ☐
Display Off ☐
Time Left Site ☐

By:

Remarks 1 low flying plane
6:22

Remarks 3 7:49 train horn 8:19
still air

Remarks 2 7:11 plane

Calibrator G R
Cal. Level 93 = 70 dB
Freq.

Site Location: Site A 1 B811 Bryan's house
Meadow and 26th

Site Map on Back of Sheet

Job No. ______

Date: 7-17-78

Sheet 2 of 3

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	4	5	6
	Dur.Hrs.	1.0	1.0	1.0
	From	8:37	10:21	11:50
	To	9:37	11.21	12:50
	L Value			
Switch Up	Max	63	66	69
	.1	59	63	64
	1	57	59	57
	10	54	55	55
	50	53	53	54
	90	52	52	52
	99	51	51	51
	Min	50	50	51
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	56	57	57
	5	55	56	56
	20	54	54	55
	Eq	53	54	54
	Dn			

Check List

Bat Test		☐
1st Run		☐
2nd Run		☐
3rd Run		☐
Mic/Aux	Aux.	☐
Weighting	A	☐
Fast Slow	slow	☐
Data Erase		☐
Cal.		☐
Altitude	152 m	☐
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		☐
Enable Run		☐
Display Off		☐
Time Left Site		☐

By: ______

Remarks 1

Remarks 3 93 = 70dB Turn over tape 12:37

Remarks 2 power mower 11:00-11:21

Calibrator 93=70dB (run 4)

Cal. Level 92=70dB (run 5)

Freq. 1 Kz

Site Location: Site Al Bill Bryan's house

Site Map on Back of Sheet

Job No.
Date: 7-17-78
Sheet 3 of 3

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	7	8	9
	Dur.Hrs.	1.0	1.0	1.0
	From	12:45	16:18	17:10
	To	13:45	17:18	18:10
	L Value			
Switch Up	Max		67	69
	.1		63	66
	1		55	56
	10		52	54
	50		51	53
	90		50	51
	99	LOST	49	50
	Min	DATA	47	48
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2		54	55
	5		53	54
	20		52	53
	Eq		52	53
	Dn			

Check List

Bat Test	
1st Run	
2nd Run	
3rd Run	
Mic/Aux	aux.
Weighting	A
Fast Slow	slow
Data Erase	
Cal.	
Altitude	152 m
Set Time	
Clock Starts	
Start Clock	
Set Time Run	
Begins	
Enable Run	
Display Off	
Time Left Site	

By:

Remarks 1 low plane at 13:00
93-70dB hammering
13:16, Heavy wind,
pulled down 13:45

Remarks 3

Remarks 2 93-70 dB, Pulled down at
18:20-faulty transmitter connection.

Calibrator
Cal. Level
Freq.

Site Location:
Bill Bryan's house

Site Map on Back of Sheet

Job No.
Date: 8-1-78
Sheet 1 of 1

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	1	2	3
	Dur.Hrs.	1.0	1.0	
	From	12.32	13.52	
	To	13:32	14:52	
	L Value	☒	☒	☒
Switch Up	Max	69		
	.1	67		
	1	59		
	10	55		
	50	54		
	90	52		
	99	51		NO
	Min	44		
Switch Down	.5/24			DATA
	1/24			
	8/24			
	.5/8			
	2	58		
	5	56		
	20	55		
	Eq	54		
	Dn			

Check List

Bat Test	
1st Run	
2nd Run	
3rd Run	
Mic/Aux	aux.
Weighting	A
Fast Slow	slow
Data Erase	
Cal.	
Altitude	152 m
Set Time	
Clock Starts	
Start Clock	
Set Time Run	
Begins	
Enable Run	
Display Off	
Time Left Site	

By:

Remarks 1 plane 13:00,
13:10
plane 12:20

Remarks 3

Remarks 2 train 14:07
14:33 down to 76 m due to winds
14:45 grounded due to winds.

Calibrator
Cal. Level 93 = 70dB
Freq. 1 Kz

Site Location: Bill Bryan's house
Down for day to windy and stormy conditions.

Site Map on Back of Sheet

engineering dynamics inc

Site 2

Site 2 was located in the Scott Carpenter Park near 30th and Arapahoe. This site was closer to more cultural activity and subjected to more motor vehicle noise than Site 1.

SITE 2

Date	Run No.	Time	Duration
4-11-78	1	05:45-06:45	1
4-11-78	2	06:47-07:47	1
4-11-78	3	07:47-08:50	1
4-11-78	4	08:53-09:53	1
4-11-78	5	09:54-10:54	1
4-11-78	6	11:14-12:14	1
4-11-78	7	12:16-13:16	1
4-11-78	8	13:17-14:17	Aborted
4-11-78	9	14:30-15:30	1
4-11-78	10	15:45-15:45	1
7-18-78	1	06:00-07:00	1
7-18-78	2	07:00-08:00	1
7-18-78	3	08:22-09:22	1
7-18-78	4	09:25-10:25	1
7-18-78	5	10:45-11:45	1
7-18-78	6	12:13-13:13	1
7-18-78	7	13:15-14:15	1
7-18-78	8	14:33-15:33	1
7-18-78	9	15:48-16:48	1
7-18-78	10	17:03-18:03	1
7-18-78	11	18:28-19:28	1
7-18-78	12	19:30-20:30	1

Job No. EPA
Date: 4-11-78
Sheet 1 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	1	2	3
	Dur.Hrs.	1	1	1
	From	5.45	6 47	7:50
	To	6 45	7.47	8:50
	L Value	☒	☒	☒
Switch Up	Max	70	63	76
	.1	65	63	72
	1	62	62	68
	10	61	61	62
	50	54	60	60
	90	58	54	59
	99	57	58	58
	Min	56	58	58
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	62	62	65
	5	61	61	62
	20	60	61	61
	Eq	59	60	61
	Dn			

Check List

Bat Test	
1st Run	
2nd Run	
3rd Run	
Mic/Aux	Aux
Weighting	"A"
Fast Slow	Slow
Data Erase	
Cal.	94=70 dB
Altitude	152.4m
Set Time	
Clock Starts	
Start Clock	
Set Time Run	
Begins	
Enable Run	
Display Off	
Time Left Site	

By: SR and GS

Remarks 1

Remarks 3 Balloon buffeted by turbulence
Tape started 800 Siren @ 8:20

Remarks 2 Still Air, Light wind occ.

Calibrator
Cal. Level 94=70 dB
Freq.

Site Location: Scott Carpenter Park Parking Lot Site # 3
30th and Arapahoe

Site Map on Back of Sheet

engineering dynamics inc

Job No. EPA
Date: 4-11-78
Sheet 2 of 4

Community Noise Analyzer Data Sheet

Test Data

	Run No.	4	5	6
	Dur.Hrs.	1	1	1
	From	8 53	9:54	11:14
	To	9:53	10:54	12:14
	L Value	☒	☒	☒
Switch Up	Max	74	78	72
	.1	72	75	68
	1	68	65	65
	10	62	62	62
	50	60	60	61
	90	54	59	59
	99	58	58	56
	Min	57	57	55
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	66	63	64
	5	64	62	63
	20	61	61	61
	Eq	61	61	61
	Dn			

Check List

Bat Test		
1st Run		☒
2nd Run		☒
3rd Run		☒
Mic/Aux	Aux	☐
Weighting	A	☐
Fast Slow	Slow	☐
Data Erase		☐
Cal.	94=70 dB	☐
Altitude	152.4m	☐
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		☐
Enable Run		☐
Display Off		☐
Time Left Site		☐

By: SR and GS

Remarks 1 Still Air
Helicopter 9:25

Remarks 3 Recal 94=70 dB

Remarks 2 Fire Truck siren and
horn 9:57
Clouds coming in

Calibrator
Cal. Level 94=70 dB
Freq.

Site Location: Site # 3 Scott Carpenter Park 30th and Arapahoe

Site Map on Back of Sheet

Job No. EPA
Date: 4-11-78
Sheet 3 of 4

Community Noise Analyzer Data Sheet

Test Data

	Run No.	7	8	9
	Dur.Hrs.	1	1	1
	From	12:16	13:17	14:13
	To	13:16	14:17	15:30
	L Value			
	Max	67		68
	.1	66		67
	1	64		65
Switch Up	10	61		63
	50	60		61
	90	59		60
	99	59		60
	Min	58	NO	57
	.5/24			
	1/24		DATA	
	8/24			
Switch Down	.5/8			
	2	63		64
	5	62		63
	20	61		62
	Eq	60		61
	Dn			

Check List

Bat Test
1st Run
2nd Run
3rd Run
Mic/Aux
Weighting
Fast Slow
Data Erase
Cal.
Altitude
Set Time
Clock Starts
Start Clock
Set Time Run
Begins
Enable Run
Display Off
Time Left Site

By:

Remarks 1

Remarks 3

Remarks 2 Wind - Aborted

Calibrator
Cal. Level
Freq.

Site Location:

Site Map on Back of Sheet

Job No. EPA
Date: 4-11-78
Sheet 4 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	10		
	Dur.Hrs.	1		
	From	15:45		
	To	16:45		
	L Value			
	Max	71		
	.1	70		
	1	64		
Switch Up	10	64		
	50	62		
	90	60		
	99	59		
	Min	58		
	.5/24			
	1/24			
	8/24			
Switch Down	.5/8			
	2	67		
	5	65		
	20	63		
	Eq	63		
	Dn			

Check List

Bat Test
1st Run
2nd Run
3rd Run
Mic/Aux
Weighting
Fast Slow
Data Erase
Cal.
Altitude
Set Time
Clock Starts
Start Clock
Set Time Run
Begins
Enable Run
Display Off
Time Left Site

By:

Remarks 1 Gusty Winds
from the west
Balloon grounded

Remarks 3

Remarks 2 High Gusty Wind, Rain
clouds moving down over the mts.
Site Abandoned - 17:15

Calibrator
Cal. Level
Freq.

Site Location:

Site Map on Back of Sheet

Job No. EPA-228
Date: 7-18-78
Sheet 1 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	1	2	3
	Dur.Hrs.	1	1	1
	From	6:00	7:00	8:22
	To	7:00	8:00	9:22
	L Value			
Switch Up	Max	66	67	72
	.1	65	66	70
	1	63	64	65
	10	61	62	62
	50	59	60	61
	90	58	59	60
	99	57	58	59
	Min	55	56	58
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	62	63	64
	5	62	63	63
	20	60	61	62
	Eq	59	61	61
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		X
3rd Run		X
Mic/Aux		
Weighting	A	
Fast Slow		
Data Erase		
Cal.		X
Altitude	152.4m	
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		
Enable Run		
Display Off		
Time Left Site		

By: GS and LG

Remarks 1 Park's Pool
Radio beginning at 6:06
G erased data

Remarks 3

Remarks 2 Radio, children
swimming 7:30 Lawn Tractor

Calibrator GR
Cal. Level 93=70 dB
Freq. 1KHz

Site Location: Site 2 Scott Carpenter Park

Site Map on Back of Sheet

Job No. EPA-228
Date: 7-18-78
Sheet 2 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	4	5	6
	Dur.Hrs.	1	1	1
	From	9:25	10:45	12:13
	To	10:25	11:45	13:13
	L Value			
Switch Up	Max	70	67	78
	.1	68	65	76
	1	65	64	68
	10	63	63	64
	50	61	61	62
	90	60	60	61
	99	59	59	60
	Min	59	59	59
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	64	64	66
	5	63	63	65
	20	62	62	63
	Eq	61	61	63
	Dn			

Check List

Bat Test	
1st Run	X
2nd Run	X
3rd Run	X
Mic/Aux	
Weighting	A
Fast Slow	
Data Erase	
Cal.	
Altitude	152.4m
Set Time	
Clock Starts	
Start Clock	
Set Time Run	
Begins	
Enable Run	
Display Off	
Time Left Site	

By: LG

Remarks 1 Pool Announcement
10:06

Remarks 3

Remarks 2 Car Horn - 11:07

Calibrator GR
Cal. Level 93=70 dB
Freq. 1KHz

Site Location: Site A2 Scott Carpenter Park

Site Map on Back of Sheet

Job No. EPA-228
Date: 7-18-78
Sheet 3 of 4

Community Noise Analyzer Data Sheet

Test Data

	Run No.	7	8	9
	Dur.Hrs.	1	1	1
	From	13 15	14 33	15 48
	To	14 15	15 33	16 48
	L Value			
	Max	78	75	75
Switch Up	.1	72	72	72
	1	67	68	67
	10	64	65	64
	50	63	63	63
	90	61	61	61
	99	61	60	61
	Min	60	60	52
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	66	67	66
	5	66	66	65
	20	64	64	64
	Eq	63	63	63
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		X
3rd Run		X
Mic/Aux		
Weighting		A
Fast Slow		
Data Erase		
Cal.		X
Altitude	152.4m	
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		☐
Enable Run		☐
Display Off		☐
Time Left Site		☐

By: NO and KR

Remarks 1 Pool Announcements 1:50, 2:04, Siren 2:15, Diesel horn 4:30

Remarks 3

Remarks 2

Calibrator GR
Cal. Level 93=70 dB
Freq. 1KHz

Site Location: A2 Scott Carpenter Park

Site Map on Back of Sheet

Job No. EPA-228
Date: 7-18-78
Sheet 4 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	10	11	12
	Dur.Hrs.	1	1	1
	From	17:03	18:28	19:30
	To	18:03	19:28	20:30
	L Value			
Switch Up	Max	72	78	76
	.1	67	74	67
	1	65	63	62
	10	63	61	60
	50	61	60	59
	90	60	59	58
	99	59	59	58
	Min	58	50	57
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	64	63	61
	5	63	62	61
	20	62	61	60
	Eq	62	61	59
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		X
3rd Run		X
Mic/~~Aux~~		
Weighting		A
Fast Slow		
Data Erase		
Cal.		
Altitude	152.4m	
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		
Enable Run		
Display Off		
Time Left Site		

By: NO

Remarks 1 Pool Announcement 5:08

Remarks 2 Pool Announcement 6:54

Remarks 3 Horn in Parking lot 7:35
Pool Radio 7:50

Calibrator GR (run 11)
Cal. Level 93=70 dB, (92=70 dB)
Freq. 1KHz

Site Location: A2 Scott Carpenter Park

Site Map on Back of Sheet

Site 3

Site 3 was located at North Boulder Park near 9th and Balsam Street which is in a residential area. This site was selected as the location that would include a weekend for comparison with weekday noise levels.

SITE 3

Date	Run No.	Time	Duration
3-31-78	1	06:45-07:45	1
3-31-78	2	08:08-09:08	1
3-31-78	3	09:10-10:10	1
3-31-78	4	10:26-11:26	1
3-31-78	5	12:27-13:27	1
3-31-78	6	15:10-16:10	1
3-31-78	7	16:12-17:15	1
3-31-78	8	17:15-18:15	1
4-1-78	1	06:15-07:15	1
4-1-78	2	07:30-08:30	1
4-1-78	3	08:43-09:43	1
4-1-78	4	09:43-10:43	1
4-1-78	5	10:43-11:43	1
4-1-78	6	12:00-13:00	1
4-1-78	7	13:00-14:00	1
4-1-78	8	14:00-15:00	Aborted
4-1-78	9	16:40-17:40	1
4-1-78	10	17:40-18:40	1
4-1-78	11	18:50-19:50	1
4-2-78	1	05:15-06:15	1
4-2-78	2	06:30-07:30	1
4-2-78	3	07:30-08:30	1
4-2-78	-	08:30-11:00	Aborted
4-2-78	4	11:04-12:04	1
4-2-78	5	12:20-13:20	1
4-2-78	6	13:35-14:45	1
4-2-78	7	14:50-15:50	1
4-2-78	7	15:55-16:25	0.5

Site 3 Continued

Date	Run No.	Time	Duration
7-21-78	1	06:18-17:18	1
7-21-78	2	08:04-08:34	0.5
7-21-78	3	10:32-11:32	1
7-21-78	4	11:34-12:34	1
7-21-78	5	12:37-13:37	1
7-21-78	6	13:55-14:55	1
7-21-78	7	15:00-16:00	1
7-21-78	8	16:27-17:27	1
7-21-78	9	17:35-18:35	Aborted
7-21-78	10	19:26-20:26	1
7-22-78	1	05:51-06:51	1
7-22-78	2	06:53-07:53	1
7-22-78	3	07:55-08:55	1
7-22-78	4	09:31-10:31	Aborted
7-22-78	5	10:31-11:31	1
7-22-78	6	11:36-12:36	1
7-22-78	7	12:50-13:50	1
7-22-78	8	14:43-15:43	1
7-22-78	9	15:46-16:46	1
7-22-78	10	17:02-18:02	1
7-22-78	11	18:16-19:16	1
7-22-78	12	19:19-20:19	1
7-23-78	1	05:55-06:55	1
7-23-78	2	06:57-07:57	1
7-23-78	3	07:59-08:59	1
7-23-78	4	09:22-10:22	1
7-23-78	5	10:28-11:28	1
7-23-78	6	11:33-12:33	1
7-23-78	7	12:35-13:35	1
7-23-78	8	13:55-14:55	1
7-23-78	9	15:00-16:00	1
7-23-78	10	16:02-17:02	1
7-23-78	11	17:17-18:17	1

Site 3 Continued

Date	Run No.	Time	Duration
7-23-78	12	18:18-19:18	1
7-23-78	13	19:31-20:31	1
7-25-78	1	05:39-06:39	1
7-25-78	2	07:33-08:33	1
7-25-78	3	08:34-08:34	1
7-25-78	4	11:21-12:21	1
7-25-78	5	12:23-13:23	1
7-25-78	6	13:41-14:41	1
7-25-78	7	14:45-15:45	1
7-25-78	-	15:47-16:12	Aborted
7-25-78	8	16:12-17:12	1
7-25-78	9	17:14-18:14	1
7-25-78	10	18:30-19:30	1
7-25-78	11	19:31-20:01	0.5

Job No. EPA-228
Date: 3-31-78
Sheet 1 of 3

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	1	2	3
	Dur. Hrs.	1	1	1
	From	[illegible]	[illegible]	[illegible]
	To	[illegible]	[illegible]	[illegible]
	L Value			
Switch Up	Max	[illegible]	[illegible]	[illegible]
	.1	[illegible]	[illegible]	[illegible]
	1	[illegible]	[illegible]	[illegible]
	10	[illegible]	[illegible]	[illegible]
	50	[illegible]	[illegible]	[illegible]
	90	[illegible]	[illegible]	[illegible]
	99	[illegible]	[illegible]	[illegible]
	Min	[illegible]	[illegible]	[illegible]
Switch Down	.1/24			
	1/24			
	8/24			
	.1/8			
	2	[illegible]	[illegible]	[illegible]
	5	[illegible]	[illegible]	[illegible]
	20	[illegible]	[illegible]	[illegible]
	Eq	[illegible]	[illegible]	[illegible]
	Dn			

Check List

- Set Test ☐
- 1st Run ☐
- 2nd Run ☐
- 3rd Run ☐
- Mic/Aux ☐
- Weighting ☐
- Fast Slow ☐
- Data Erase ☐
- Cal. ☐
- Altitude ☐
- Set Time
- Clock Starts ☐
- Start Clock
- Set Time Run ☐
- Begins ☐
- Enable Run ☐
- Display Off ☐
- Time Left Site ☐

By:

Remarks 1

Remarks 3

Remarks 2 Plane flew close to
Balloon @ 9:[illegible]

Calibrator [illegible]
Cal. Level
Freq.

Site Location: North Boulder Park

Site Map on Back of Sheet

engineering dynamics inc

Job No. EPA-228
Date: 3-31-78
Sheet 2 of 3

Community Noise Analyzer
Data Sheet

Test Data

		Run No.	4	5	6
		Dur.Hrs.	1	1	1
		From	10 16	12 17	15 10
		To	11 16	13 17	16 10
		L Value			
		Max	[illegible]	84	71
Switch Up		.1	72	79	68
		1	66	69	60
		10	59	59	57
		50	54	54	54
		90	50	49	50
		99	53	57	49
		Min	42	45	47
Switch Down		.5/24			
		1/24			
		8/24			
		.5/8			
		2	69	63	67
		5	61	60	58
		20	58	64	57
		Eq	70	79	71
		Dn			

Check List

Bat Test
1st Run
2nd Run
3rd Run
Mic/Aux
Weighting
Fast Slow
Data Erase
Cal.
Altitude
Set Time
Clock Starts
Start Clock
Set Time Run
Begins
Enable Run
Display Off
Time Left Site

By:

Remarks 1

Remarks 3

Remarks 2 Received static?
No apparent explanation

Calibrator [illegible] dB
Cal. Level
Freq. [illegible]

Site Location: North Boulder Park

Site Map on Back of Sheet

engineering dynamics inc

Job No. EPA-228
Date: 3-31-78
Sheet 3 of 3

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	7	8	
	Dur. Hrs.	1	1	
	From	16 15	17 15	
	To	17 15	18 15	
	L Value			
Switch Up	Max	70	68	
	.1	65	67	
	1	62	64	
	10	58	57	
	50	56	54	
	90	54	55	
	99	54	54	
	Min	52	52	
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	60	61	
	5	58	58	
	20	57	57	
	Eq	57	55	
	Dn			

Check List

Bat Test
1st Run ☐
2nd Run ☐
3rd Run ☐
Mic/Aux ☐
Weighting ☐
Fast Slow ☐
Data Erase ☐
Cal. ☐
Altitude ☐
Set Time
Clock Starts ☐
Start Clock
Set Time Run ☐
Begins ☐
Enable Run ☐
Display Off ☐
Time Left Site ☐

By:

Remarks 1

Remarks 3

Remarks 2

Calibrat.
Cal. Level 93-[illegible] dB
Freq.

Site Location: South Boulder Park

Site Map on Back of Sheet

Job No. EPA-228
Date: 4-1-78
Sheet 1 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	1	2	3
	Dur.Hrs.	1	1	1
	From	6 15	7 30	8 43
	To	7 15	8 30	9 43
	L Value			
	Max	[illegible]	63	64
	.1	61	60	61
Switch Up	1	56	56	57
	10	54	53	54
	50	51	51	52
	90	50	50	51
	99	49	50	50
	Min	48	49	48
	.5/24			
	1/24			
	8/24			
Switch Down	.5/8			
	2	55	55	56
	5	54	54	55
	10	51	51	53
	Eq	51	51	53
	Dn			

Check List

Bat Test
1st Run ☒
2nd Run ☐
3rd Run ☐
Mic/Aux ☐
Weighting A ☐
Fast Slow ☐
Data Erase ☐
Cal. ☐
Altitude 152.4m ☐
Set Time
Clock Starts ☐
Start Clock
Set Time Run ☐
Begins ☐
Enable Run ☐
Display Off ☐
Time Left Site ☐

By: GS

Remarks 1

Remarks 3 08:54 Light plane, 1000 chain saw, 10:58 Siren

Remarks 2

Calibrator
Cal. Level
Freq.

Site Location: Site #1 North Boulder Park at 9th and Balsam

Site Map on Back of Sheet

engineering dynamics inc

Job No. EPA-228
Date: 4-1-78
Sheet 2 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	4	5	6
	Dur.Hrs.	1	1	1
	From	9 48	10 48	12 00
	To	10 48	11 48	13 00
	L Value			
Switch Up	Max	70	70	62
	.1	63	67	60
	1	59	60	59
	10	55	55	56
	50	53	54	55
	90	52	53	54
	99	51	52	53
	Min	50	51	53
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	58	58	58
	5	56	56	57
	20	54	55	56
	Eq	60	59	55
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		X
3rd Run		
Mic/Aux		
Weighting	A	
Fast Slow		
Data Erase		
Cal.		
Altitude	152.4m	
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		
Enable Run		X
Display Off		
Time Left Site		

By:

Remarks 1
10:00 Chain Saw

Remarks 3 Rain 12:15 (shower)

Remarks 2 10:58 Siren

Calibrator OK
Cal. Level 70 dB 1000 Hz=94 dB
Freq. 1000 Hz CNA

Site Location: Site # 3 North Boulder Park at 9th and Balsam

Start Tape. Side 1 12:00 Cal: 90 dB 1KHz
Side 2 12:30 ends 1:40

Site Map on Back of Sheet

engineering dynamics inc

Job No. EPA-228
Date: 4-1-78
Sheet 3 of 4

Community Noise Analyzer
Data Sheet

Test Data

		Run No.	7	8	9
		Dur.Hrs.	1	1	1
		From	1300	1400	1640
		To	1400	1500	1740
		L Value	☒	☒	☒
	Switch Up	Max	65		65
		.1	62		63
		1	59		59
		10	56		56
		50	55		54
		90	53		53
		99	52	NO	52
		Min	51		52
	Switch Down	.5/24		DATA	
		1/24			
		8/24			
		.5/8			
		2	58		58
		5	57		57
		20	56		55
		Eq	55		55
		Dn			

Check List

Bat Test		
1st Run		☒
2nd Run		☐
3rd Run		☐
Mic/Aux		☐
Weighting	A	☐
Fast Slow		☐
Data Erase		☐
Cal.		☐
Altitude	152.4m	☐
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		☐
Enable Run		☐
Display Off		☐
Time Left Site		☐

By: TCF

Remarks 1
12:25 Thunder
12:30 Jet

Remarks 3

Remarks 2 14:25 Rain, Thunder
Rained out

Calibrator GR
Cal. Level 0 dB = 94 CNA
Freq. 1KHz

Site Location: North Boulder Park at 9th and Balsam - Site # 3

Site Map on Back of Sheet

engineering dynamics inc

Job No. EPA-228
Date: 4-1-78
Sheet 4 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	10	11	
	Dur.Hrs.	1		
	From	1740	1850	
	To	1840	1950	
	L Value			
Switch Up	Max	96	64	
	.1	96	63	
	1	82	60	
	10	69	56	
	50	57	54	
	90	53	53	
	99	52	52	
	Min	51	52	
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	81	57	
	5	74	56	
	20	63	54	
	Eq	71	54	
	Dn			

Check List

Bat Test		
1st Run		☒
2nd Run		☐
3rd Run		☐
Mic/Aux		☐
Weighting	A	☐
Fast Slow		☐
Data Erase		☐
Cal.	70 dB	☐
Altitude		☐
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		☐
Enable Run		☐
Display Off		☐
Time Left Site		☐

By:

Remarks 1

Remarks 1

Remarks 2

Calibrator OK
Cal. Level 70 dB = 94 CAL
Freq. 1KHZ

Site Location: Site # 3 - North Boulder Park at 9th and Balsam

Site Map on Back of Sheet

engineering dynamics inc

Job No. EPA-228
Date: 4-2-78
Sheet 1 of 3

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	'	2	3
	Dur.Hrs.	1	1	1
	From	5 15	6 30	7 30
	To	6 15	7 30	8:30
	L Value	☒	☒	☒
Switch Up	Max	52	53	72
	.1	51	52	68
	1	50	51	61
	10	48	49	52
	50	46	47	50
	90	45	46	48
	99	44	45	47
	Min	43	44	45
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	50	31	59
	5	49	50	54
	20	47	48	51
	Eq	47	48	52
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		
3rd Run		
Mic/Aux	Aux	X
Weighting	A	X
Fast Slow	S	X
Data Erase		
Cal.	70=94	
Altitude	152 m	
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		☐
Enable Run		☐
Display Off		☐
Time Left Site		☐

By: HM

Remarks 1

Remarks 3

Remarks 2

Calibrator
Cal. Level
Freq.

Site Location: Park - Sunday - April 2, 1978 - North Boulder

Site Map on Back of Sheet

Job No. EPA-228
Date: 4-2-78
Sheet 2 of 3

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	4	5	6
	Dur.Hrs.	1	1	1
	From	11:04	12:20	13:35
	To	1204	13:20	14:45
	L Value	☒	☒	☒
Switch Up	Max	64	74	62
	.1	65	64	61
	1	59	66	60
	10	55	56	56
	50	52	53	53
	90	51	52	52
	99	50	51	51
	Min	43	45	50
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	58	59	59
	5	56	57	57
	20	54	55	56
	Eq	53	56	56
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		
3rd Run		
Mic/Aux	Aux	
Weighting	A	
Fast Slow	Slow	
Data Erase		
Cal.	70 dB = 94	
Altitude	152.4m	
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		☐
Enable Run		☐
Display Off		X
Time Left Site		☐

By: SR

Remarks 1

Remarks 3

Remarks 2

Calibrator
Cal. Level
Freq.

Site Location: North Boulder Park - 4-2-78

Site Map on Back of Sheet

Job No. EPA-228
Date: 4-2-78
Sheet 3 of 3

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	7	8	9
	Dur.Hrs.	14 50	15:55	16:30
	From	15:50	16:25	17:00
	To	1	0.5	0.5
	L Value	☒	☒	☒
Switch Up	Max	65	67	
	.1	64	66	
	1	60	63	
	10	56	58	
	50	53	55	
	90	52	53	
	99	51	52	NO
	Min	49	51	
Switch Down	.5/24			DATA
	1/24			
	8/24			
	.5/8			
	2	59	61	
	5	57	59	
	20	55	57	
	Eq	54	56	
	Dn			

Check List

Bat Test
1st Run ☐
2nd Run ☐
3rd Run ☐
Mic/Aux ☐
Weighting ☐
Fast Slow ☐
Data Erase ☐
Cal. ☐
Altitude ☐
Set Time
Clock Starts ☐
Start Clock
Set Time Run ☐
Begins ☐
Enable Run ☐
Display Off ☐
Time Left Site ☐

By:

Remarks 1

Remarks 3

Remarks 2

Calibrator
Cal. Level
Freq.

Site Location:

Site Map on Back of Sheet

Job No. EPA-228
Date: 7-21-78
Sheet 1 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	1	2	3
	Dur.Hrs.	1	0.5	1
	From	6 18	8 04	10:32
	To	7:18	8:34	11:32
	L Value	X	X	X
Switch Up	Max	57	72	60
	.1	56	64	59
	1	55	66	57
	10	53	59	56
	50	51	55	55
	90	49	53	53
	99	48	52	52
	Min	46	51	51
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	54	65	57
	5	53	63	56
	20	52	57	55
	Eq	51	57	55
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		
3rd Run		
Mic/Aux		
Weighting		A
Fast Slow		
Data Erase		
Cal.		
Altitude	152.4m	
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		
Enable Run		
Display Off		
Time Left Site		

By: GS

Remarks 1

Remarks 3 Limb Shredder, 94 dB, 8:09,
Chain Saw 81, Limb Shredder - 85
8:35 - Rain Starts

Remarks 2

Calibrator
Cal. Level 93=70 dB
Freq. 1KHz

Site Location: A3 - NorthBoulder Park

Site Map on Back of Sheet

Job No. EPA-228
Date: 7-21-78
Sheet 2 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	4	5	6
	Dur.Hrs.	1	1	1
	From	11:34	12:37	13 55
	To	12:34	13 37	14:55
	L Value	☒	☒	☒
Switch Up	Max	63	63	65
	.1	61	61	62
	1	58	57	54
	10	56	55	55
	50	54	54	54
	90	53	53	53
	99	53	52	52
	Min	52	51	51
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	58	56	68
	5	57	55	56
	20	56	54	55
	Eq	55	54	54
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		X
3rd Run		
Mic/Aux		
Weighting		A
Fast Slow		
Data Erase		
Cal.		X
Altitude	152.4m	
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		☐
Enable Run		☐
Display Off		☐
Time Left Site		☐

By: DM and LG

Remarks 1 12:13 Buzzer

Remarks 3

Remarks 2

Calibrator GR
Cal. Level93=70 dB
Freq. 1KHz

Site Location: A3 North Boulder Park

Site Map on Back of Sheet

Job No. EPA 228
Date: 7-21-78
Sheet 3 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	7	8	9
	Dur.Hrs.	1	1	1
	From	15:00	16.27	17 35
	To	16 00	17:27	18 35
	L Value	☒	☒	☒
Switch Up	Max	78	61	
	.1	74	60	
	1	65	58	
	10	57	56	
	50	54	55	
	90	53	54	
	99	52	53	
	Min	51	43	NO
Switch Down	.5/24			
	1/24			DATA
	8/24			
	.5/8			
	2	60	57	
	5	58	57	
	20	55	56	
	Eq	56	55	
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		
3rd Run		
Mic/Aux		
Weighting		A
Fast Slow		
Data Erase		
Cal.		A
Altitude	152.4m	
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		☐
Enable Run		☐
Display Off		☐
Time Left Site		☐

By: LG

Remarks 1 Ambulance 3:56

Remarks 3 Rain and Heavy Wind - Pulled Down

Remarks 2

Calibrator GR
Cal. Level 93=70 dB
Freq. 1KHz

Site Location: A3 North Boulder Park

Site Map on Back of Sheet ☐

engineering dynamics inc

Job No. EPA-228
Date: 7-21-78
Sheet 4 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	10		
	Dur.Hrs.	1		
	From	19:26		
	To	20:26		
	L Value	X	X	X
Switch Up	Max	62		
	.1	61		
	1	58		
	10	56		
	50	54		
	90	52		
	99	51		
	Min	50		
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	57		
	5	56		
	20	55		
	Eq	54		
	Dn			

Check List

Bat Test		X
1st Run		☐
2nd Run		☐
3rd Run		☐
Mic/Aux		☐
Weighting		A
Fast Slow		☐
Data Erase		☐
Cal.		X
Altitude	152.4m	☐
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		☐
Enable Run		☐
Display Off		☐
Time Left Site		☐

By: LG

Remarks 1

Remarks 3

Remarks 2

Calibrator GR
Cal. Level 93-70 dB
Freq. 1KHz

Site Location: A 3 North Boulder Park

Site Map on Back of Sheet

engineering dynamics inc

Job No. EPA-228
Date: 7-22-78
Sheet 1 of 4

Community Noise Analyzer Data Sheet

Test Data

	Run No.	1	2	3
	Dur.Hrs.	1	1	1
	From	5·51	6 53	7 55
	To	6 51	7·53	8 55
	L Value	☒	☒	☒
Switch Up	Max	64	62	63
	.1	62	60	61
	1	55	54	57
	10	51	51	54
	50	47	47	51
	90	45	48	49
	99	43	47	48
	Min	41	46	48
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	53	53	56
	5	51	52	55
	20	48	51	53
	Eq	48	50	52
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		X
3rd Run		X
Mic/Aux		
Weighting		A
Fast Slow		
Data Erase		
Cal.		
Altitude	152.4m	
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		☐
Enable Run		☐
Display Off		☐
Time Left Site		☐

By: GS and DM

Remarks 1 Run 1 stopped Due to Emergency Helicopter landing in Park
* Sirens

Remarks 3

Remarks 2 Stanley Steamer
Garbage Truck 7:01

Calibrator
Cal. Level 93=70 dB
Freq. 1KHz

Site Location: A3 North Boulder Park
* Run 1 - 6:20 Balloon to 30.48m, wait for helicopter, Sherrif informed us of maneuver cancellation, Balloon to 152.4m at 6:30
Weather: overcast, cool

Site Map on Back of Sheet

Job No. EPA-228
Date: 7-22-78
Sheet 2 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	4	5	6
	Dur.Hrs.	1	1	1
	From	9:31	10:31	11:36
	To	10:31	11:31	12:36
	L Value	☒	☒	☒
	Max		63	71
	.1		61	68
	1		54	62
Switch Up	10		56	57
	50		54	55
	90		53	53
	99	NO	52	53
	Min		45	52
	.5/24	DATA		
	1/24			
	8/24			
Switch Down	.5/8			
	2		58	60
	5		57	58
	20		55	56
	Eq		55	56
	Dn			

Check List

Bat Test		
1st Run		☒
2nd Run		☐
3rd Run		☐
Mic/**Aux**		☐
Weighting		A
Fast **Slow**		☐
Data Erase		☐
Cal.		☐
Altitude	152.4m	☐
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		☐
Enable Run		☐
Display Off		☐
Time Left Site		☐

By: DM

Remarks 1 9:42 airplane
Transmitter Batteries wear
Take Balloon down to change

Remarks 3

Remarks 2

Calibrator
Cal. Level 93=70 dB
Freq. 1KHz

Site Location: A 3 North Boulder Park

Site Map on Back of Sheet

Job No. EPA-228
Date: 7-22-78
Sheet 3 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	7	8	9
	Dur.Hrs.	1	1	1
	From	12:50	14:43	15:46
	To	13:50	15:43	16:46
	L Value	☒	☒	☒
Switch Up	Max	68	67	64
	.1	66	66	66
	1	62	62	61
	10	58	58	57
	50	55	55	55
	90	53	53	53
	99	52	52	52
	Min	51	51	51
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	61	61	60
	5	58	54	58
	20	57	57	56
	Eq	55	56	55
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		
3rd Run		
Mic/Aux		
Weighting		A
Fast Slow		
Data Erase		
Cal.		
Altitude	152.4m	
Set Time		
Clock Starts		
Start Clock		
Set Time Run		
Begins		
Enable Run		
Display Off		
Time Left Site		

By:

Remarks 1

Remarks 3 Helicopter 3:55

Remarks 2

Calibrator
Cal. Level 93=70 dB
Freq. 1KHz

Site Location: A3 North Boulder Park

Site Map on Back of Sheet

engineering dynamics, inc

Job No. EPA-228
Date: 7-22-78
Sheet 4 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	10	11	12
	Dur.Hrs.	1	1	1
	From	17 02	18:16	19:19
	To	18:02	19:16	20:19
	L Value	☒	☒	☒
Switch Up	Max	63	65	64
	.1	62	63	62
	1	59	60	59
	10	56	57	55
	50	54	53	53
	90	52	52	51
	99	51	51	50
	Min	51	42	50
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	58	54	58
	5	56	58	57
	20	55	55	54
	Eq	54	54	53
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		
3rd Run		
Mic/[✓ Aux]		
Weighting		A
Fast [✓ Slow]		
Data Erase		
Cal.		X
Altitude	152.4m	
Set Time		
Clock Starts		
Start Clock		
Set Time Run		
Begins		
Enable Run		
Display Off		
Time Left Site		

By: LG and DM

Remarks 1

Remarks 3

Remarks 2

Calibrator GR
Cal. Level 93=70 dB
Freq. 1KHz

Site Location: A3 North Boulder Park

Site Map on Back of Sheet

Job No.

Date: 7-23-78

Sheet 1 of 5

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	1	2	3
	Dur.Hrs.	1	1	1
	From	5:55	6:57	7:54
	To	6:55	7:57	8:54
	L Value	☒	☒	☒
Switch Up	Max	54	56	62
	.1	53	53	61
	1	50	51	58
	10	48	49	53
	50	46	47	50
	90	44	46	47
	99	43	45	46
	Min	43	44	46
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	49	50	57
	5	48	50	55
	20	47	48	51
	Eq	46	49	51
	Dn			

Check List

Bat Test	
1st Run	
2nd Run	
3rd Run	
Mic/Aux	aux.
Weighting	A
Fast Slow	slow
Data Erase	
Cal.	
Altitude	152 m
Set Time	
Clock Starts	
Start Clock	
Set Time Run	
Begins	
Enable Run	
Display Off	
Time Left Site	

By:

Remarks 1

Remarks 3 7:59 - 8:02 loud dog barking -continual. 8:20 airplane, 8:29 whistle

Remarks 2

Calibrator GR

Cal. Level 93=70dB

Freq.

Site Location: A3 North Boulder Park

Dog - Frisbee contest form 9:00 on, a lot of barking

Site Map on Back of Sheet

Job No.
Date: 7-23-78
Sheet 2 of 5

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	4	5	6
	Dur.Hrs.	1	1	1
	From	9:22	10:28	11:33
	To	10:22	11:28	12:33
	L Value	☒	☒	☒
Switch Up	Max	63	66	67
	.1	61	65	65
	1	58	60	62
	10	55	56	57
	50	52	53	54
	90	51	52	53
	99	50	51	52
	Min	49	49	51
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	57	54	60
	5	56	57	58
	20	54	55	56
	Eq	53	54	56
	Dn			

Check List

Bat Test	
1st Run	
2nd Run	
3rd Run	
Mic/Aux	
Weighting	A
Fast Slow	
Data Erase	
Cal.	
Altitude	152 m
Set Time	
Clock Starts	
Start Clock	
Set Time Run	
Begins	
Enable Run	
Display Off	
Time Left Site	

By:

Remarks 1

Remarks 3

Remarks 2

Calibrator
Cal. Level 93=70dB
Freq.

Site Location: A3 North Boulder Park

Site Map on Back of Sheet

Job No.
Date: 7-23-78
Sheet 3 of 5

Community Noise Analyzer Data Sheet

Test Data

		Run No.	7	8	9
		Dur.Hrs.	1	1	1
		From	12:35	13:55	15:00
		To	13:35	14:55	16:00
		L Value	☒	☒	☒
Switch Up		Max	63	63	62
		.1	61	62	61
		1	59	60	59
		10	56	57	56
		50	53	54	54
		90	52	52	52
		99	51	51	51
		Min	50	49	50
Switch Down		.5/24			
		1/24			
		8/24			
		.5/8			
		2	58	59	58
		5	57	58	57
		20	55	55	55
		Eq	54	54	54
		Dn			

Check List

Bat Test	
1st Run	
2nd Run	
3rd Run	
Mic/Aux	
Weighting	
Fast Slow	
Data Erase	
Cal.	
Altitude	152 m
Set Time	
Clock Starts	
Start Clock	
Set Time Run	
Begins	
Enable Run	
Display Off	
Time Left Site	

By:

Remarks 1 1:02 airplane

Remarks 3

Remarks 2

Calibrator
Cal. Level 93=70dB
Freq.

Site Location:
A3 North Boulder Park

Site Map on Back of Sheet

engineering dynamics, inc

Job No.
Date: 7-23-78
Sheet 4 of 5

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	10	11	12
	Dur.Hrs.	1	1	1
	From	16:02	17:17	18:18
	To	17:02	18:17	19:18
	L Value	☒	☒	☒
Switch Up	Max	75	66	76
	.1	73	62	66
	1	68	59	61
	10	57	56	56
	50	53	53	53
	90	51	51	51
	99	50	50	50
	Min	48	49	49
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	65	58	54
	5	60	57	57
	20	55	55	54
	Eq	57	54	54
	Dn			

Check List

Bat Test		
1st Run		☐
2nd Run		☐
3rd Run		☐
Mic/Aux		☐
Weighting		☐
Fast Slow		☐
Data Erase		☐
Cal.		☐
Altitude	152 m	☐
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		☐
Enable Run		☐
Display Off		☐
Time Left Site		☐

By:

Remarks 1 4:52 police sirens; 5:00 siren

Remarks 3 Max. value unaccountable

Remarks 2

Calibrator
Cal. Level 93=70dB
Freq.

Site Location:
A3 North Boulder Park

Site Map on Back of Sheet

Job No. ____
Date: 7-23-78
Sheet 5 of 5

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	13		
	Dur.Hrs.	1		
	From	19 31		
	To	20:31		
	L Value	☒	☒	☒
Switch Up	Max	66		
	.1	65		
	1	62		
	10	58		
	50	55		
	90	53		
	99	51		
	Min	51		
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	61		
	5	59		
	20	57		
	Eq	56		
	Dn			

Check List

Bat Test ____
1st Run ____ ☐
2nd Run ____ ☐
3rd Run ____ ☐
Mic/Aux ____ ☐
Weighting ____ ☐
Fast Slow ____ ☐
Data Erase ____ ☐
Cal. ____ ☐
Altitude 152 m ☐
Set Time
Clock Starts ____ ☐
Start Clock
Set Time Run ____ ☐
Begins ____ ☐
Enable Run ____ ☐
Display Off ____ ☐
Time Left Site ____ ☐

By: ____

Remarks 1 7:59 siren

Remarks 3

Remarks 2

Calibrator ____
Cal. Level ____
Freq. ____

Site Location: North Boulder Park

Site Map on Back of Sheet

engineering dynamics, inc

Job No. EPA-228
Date: 7--25-78
Sheet 1 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	1	2	3
	Dur.Hrs.	1	1	1
	From	5:34	7:33	8:34
	To	6:34	8:33	9:34
	L Value	☒	☒	☒
Switch Up	Max	81	68	
	.1	78	67	
	1	72	62	
	10	62	58	
	50	55	55	
	90	51	53	
	99	48	52	NO
	Min	47	51	
Switch Down	.5/24			DATA
	1/24			
	8/24			
	.5/8			
	2	64	61	
	5	65	54	
	20	54	57	
	Eq	60	56	
	Dn			

Check List

Bat Test		
1st Run		☒
2nd Run		☐
3rd Run		☐
Mic/Aux		☐
Weighting	A	☐
Fast Slow		☐
Data Erase		☒
Cal.		☒
Altitude	152.4m	☐
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		☐
Enable Run		☐
Display Off		☐
Time Left Site		☐

By: GS and DM

Remarks 1 Windy - pkg
making noise

Change line

Remarks 3
Park turned on sprinkler, soaked everything. Run cut short

Remarks 2 Windy
Balloon to 30.48m due to wind

Calibrator GR
Cal. Level 93=70 dB
Freq. 1KHz

Site Location: Site A 3 North Boulder Park

Site Map on Back of Sheet

Job No. EPA-228
Date: 7-25-78
Sheet 2 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	4	5	6
	Dur.Hrs.	1	1	1
	From	11:21	12:23	13:41
	To	12:21	13:23	14:41
	L Value	☒	☒	☒
Switch Up	Max	64	78	78
	.1	63	75	74
	1	60	61	65
	10	57	56	56
	50	54	54	54
	90	53	52	52
	99	52	51	51
	Min	51	50	42
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	54	54	62
	5	58	57	58
	20	56	55	55
	Eq	55	56	56
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		☐
3rd Run		☐
Mic/Aux		☐
Weighting		A
Fast Slow		☐
Data Erase		☐
Cal.		☐
Altitude	152.4m	☐
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		☐
Enable Run		☐
Display Off		☐
Time Left Site		☐

By: DM and LG

Remarks 1 Windy

Remarks 3 Windy - Package Noisy
Siren 1:50

Remarks 2 Windy

Calibrator GR
Cal. Level 92=70 dB
Freq. 1KHz

Site Location: Site A 3 North Boulder Park

Site Map on Back of Sheet

engineering dynamics inc

Job No. EPA-228
Date: 7-25-78
Sheet 3 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	7		8
	Dur.Hrs.	1		1
	From	14:45		16:12
	To	15:45		17:12
	L Value			
Switch Up	Max	77		63
	.1	67		60
	1	62		54
	10	57		57
	50	54		55
	90	53		53
	99	52		53
	Min	51		51
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	54		54
	5	57		58
	20	56		56
	Eq	55		55
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		
3rd Run		
Mic/Aux		
Weighting		A
Fast Slow		
Data Erase		
Cal.		
Altitude	152.4m	
Set Time		
Clock Starts		
Start Clock		
Set Time Run		
Begins		
Enable Run		
Display Off		
Time Left Site		

By: NO

Remarks 1 Lost power for 1 second - 3:43, Intermittant Thunder

Remarks 3

Remarks 2 Siren-3:48, Loud dog barking-Intermittant Thunder-4:12 Power Out Start Over

Calibrator
Cal. Level 92=70 dB
Freq. 1KM

Site Location: Site A3 North Boulder Park

Site Map on Back of Sheet

engineering dynamics, inc

Job No. EPA-228
Date: 7-25-78
Sheet 3 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	7		8
	Dur.Hrs.	1		1
	From	14:45		16:12
	To	15:45		17:12
	L Value	☒	☒	☒
Switch Up	Max	77		63
	.1	67		60
	1	62		59
	10	57		57
	50	54		55
	90	53		53
	99	52		53
	Min	51		51
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	54		59
	5	57		58
	20	56		56
	Eq	55		55
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		
3rd Run		
Mic/Aux		
Weighting		A
Fast Slow		
Data Erase		
Cal.		
Altitude	152.4m	
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		
Enable Run		
Display Off		
Time Left Site		

By: NO

Remarks 1 Lost power for 1 second - 3:43, Intermittant Thunder

Remarks 3

Remarks 2 Siren-3:48, Loud dog barking-Intermittant Thunder-4:12 Power Out Start Over

Calibrator
Cal. Level 92=70 dB
Freq. 1KM

Site Location: Site A3 North Boulder Park

Site Map on Back of Sheet

engineering dynamics inc

Job No. EPA-228
Date: 7-25-78
Sheet 4 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	9	10	11
	Dur.Hrs.	1	1	0.5
	From	17:14	18:30	19:31
	To	18:14	19:30	20:01
	L Value	☒	☒	☒
Switch Up	Max	66	67	84
	.1	63	60	84
	1	59	58	84
	10	57	56	60
	50	55	54	55
	90	53	52	52
	99	52	51	51
	Min	51	45	43
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	59	58	83
	5	58	56	66
	20	56	55	58
	Eq	55	54	68
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		
3rd Run		
Mic/Aux		
Weighting		A
Fast Slow		
Data Erase		
Cal.		
Altitude	152.4m	
Set Time Clock Starts		☐
Start Clock Set Time Run Begins		☐
Enable Run		
Display Off		
Time Left Site		

By: NO and DM

Remarks 1 Thunder 5:15
5:25 Thunder Periodically

Remarks 3 Windy Elevation Changing
Rain Sprinkling starts at 7:45
7:57 Thunder Tuning Wandering
8:00 Lighting?

Remarks 2 Windy

Calibrator
Cal. Level 92=70 dB - Run 9
Freq. 1KM 93=70 dB - Run 10

Site Location: A3 North Boulder Park

Site Map on Back of Sheet

Site 4

Site 4 is located at 1210 Hartford and at 1285 Georgetown Street. The first set of measurements were conducted at 1210 Hartford in the winter season. When the balloon was taken back to this site the technicians manning the station were met with obscenities and threats of violence. Rather than waste time attemptint to negotiate with the individual it was deemed expedient to relocate to the adjacent block where the site was established without incident at 1285 Georgetown Street.

SITE 4

Date	Run No.	Time	Duration
4-13-78	1	05:55-06:55	1
4-13-78	2	06:55-07:55	1
4-13-78	3	07:58-08:58	1
4-13-78	-	08:58-11:45	Aborted
4-13-78	4	11:45-12:45	1
4-13-78	5	12:46-13:46	1
4-13-78	6	14:00-15:00	1
4-13-78	7	16:30-17:00	½
4-13-78	8	17:15-18:15	1
7-20-78	1	05:44-06:44	1
7-20-78	-	06:44-09:28	Aborted
7-20-78	2	09:28-10:28	1
7-20-78	3	10:32-11:32	1
7-20-78	4	11:46-12:46	1
7-20-78	5	12:46-13:46	1
7-20-78	6	15:48-16:48	1
7-20-78	7	17:38-18:38	1
7-20-78	8	18:38-19:38	1
7-20-78	9	19:38-20:38	1

Job No. EPA-228
Date: 4-13-78
Sheet 1 of 3

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	1	2	3
	Dur.Hrs.	1.0	1.0	1.0
	From	5.55	6.55	7.58
	To	6.55	7.55	8.58
	L Value	☒	☒	☒
Switch Up	Max	64	59	60
	.1	60	59	59
	1	58	58	58
	10	56	57	56
	50	54	55	54
	90	52	54	52
	99	50	52	51
	Min	50	51	50
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	57	58	57
	5	56	57	56
	20	55	56	55
	Eq	54	55	54
	Dn			

Check List

Bat Test	
1st Run	
2nd Run	
3rd Run	
Mic/Aux	Aux
Weighting	A
Fast Slow	Slow
Data Erase	
Cal.	94=70 dB
Altitude	
Set Time	
Clock Starts	
Start Clock	
Set Time Run	
Begins	
Enable Run	
Display Off	
Time Left Site	

By:

Remarks 1 Still air
Little traffic static
(hi(max)) Dogs

Remarks 3 Still Air

Remarks 2 Still Air, Dogs,
Little traffic

Calibrator
Cal. Level 94=70 dB
Freq. 1KHz

Site Location: Site A 4 1210 Hartford

Site Map on Back of Sheet

engineering dynamics, inc

Job No. EPA-228
Date: 4-13-78
Sheet 2 of 3

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	4	5	6
	Dur.Hrs.	1 0	1 0	1.0
	From	11.45	12.46	14 00
	To	12.45	13.46	15:00
	L Value	☒	☒	☒
Switch Up	Max	64	62	63
	.1	63	59	62
	1	58	58	59
	10	55	56	55
	50	53	53	52
	90	51	51	51
	99	51	50	50
	Min	43	49	50
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	57	57	58
	5	56	56	56
	20	54	55	53
	Eq	54	54	53
	Dn			

Check List

- Bat Test ☐
- 1st Run ☐
- 2nd Run ☐
- 3rd Run ☐
- Mic/Aux ☐
- Weighting ☐
- Fast Slow ☐
- Data Erase ☐
- Cal. ☐
- Altitude ☐
- Set Time
- Clock Starts ☐
- Start Clock
- Set Time Run ☐
- Begins ☐
- Enable Run ☐
- Display Off ☐
- Time Left Site ☐

By:

Remarks 1

Remarks 3

Remarks 2

Calibrator
Cal. Level
Freq.

Site Location: Site A 4

Site Map on Back of Sheet

Job No. EPA-228
Date: 4-13-78
Sheet 3 of 3

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	7	8	
	Dur.Hrs.	.5	1.0	
	From	1630	17.15	
	To	17.00	18.15	
	L Value	☒	☒	☒
Switch Up	Max	64	63	
	.1	63	62	
	1	61	60	
	10	58	57	
	50	56	55	
	90	53	52	
	99	52	51	
	Min	50	49	
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	60	59	
	5	59	58	
	20	57	56	
	Eq	56	55	
	Dn			

Check List

Bat Test	
1st Run	
2nd Run	
3rd Run	
Mic/Aux	Aux
Weighting	A
Fast Slow	Slow
Data Erase	
Cal.	94=70 dB
Altitude	
Set Time	
Clock Starts	
Start Clock	
Set Time Run	
Begins	
Enable Run	
Display Off	
Time Left Site	

By:

Remarks 1

Remarks 3

Remarks 2

Calibrator
Cal. Level
Freq.

Site Location: 1210 Hartford Aite A4

Site Map on Back of Sheet

Job No. EPA-228
Date: 7-20-78
Sheet 1 of 3

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	1	2	3
	Dur.Hrs.	1 0	1.0	1.0
	From	5.44	9.28	10:32
	To	6.44	10:28	11:32
	L Value	X	X	X
Switch Up	Max	82	62	61
	.1	67	60	60
	1	52	58	58
	10	50	55	56
	50	46	53	54
	90	44	51	52
	99	43	50	51
	Min	42	49	49
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	52	57	58
	5	51	56	57
	20	49	55	56
	Eq	49	54	54
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		
3rd Run		
Mic/Aux		
Weighting		A
Fast Slow		
Data Erase		
Cal.		X
Altitude	152.4m	
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		☐
Enable Run		☐
Display Off		☐
Time Left Site		☐

By: LG

Remarks 1
105 Max Unaccountable

Remarks 3

Remarks 2

Calibrator
Cal. Level 93=70 dB
Freq. 1KHz

Site Location: Site A4 1285 Georgetown Street

Site Map on Back of Sheet

engineering dynamics inc

Job No. EPA-228
Date: 7-20-78
Sheet 2 of 3

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	4	5	6
	Dur.Hrs.	1.0	1.0	1.0
	From	11.46	14.46	15:43
	To	12.46	15:46	16:48
	L Value	╳	╳	╳
Switch Up	Max	63	63	61
	.1	60	62	60
	1	58	58	59
	10	55	54	56
	50	52	52	53
	90	51	50	51
	99	50	49	50
	Min	42	43	49
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	57	57	58
	5	56	55	57
	20	54	53	55
	Eq	53	52	54
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		
3rd Run		
Mic/Aux		
Weighting		A
Fast Slow		
Data Erase		
Cal.		X
Altitude	152.4m	
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		
Enable Run		
Display Off		
Time Left Site		

By: LG

Remarks 1

Remarks 3 Some Package Noise

Remarks 2
93=70 dB
Thunder 1:40 run stopped-thunder

Calibrator GR
Cal. Level 93=70 dB
Freq. 1KHz

Site Location: storm-Run started after Storm

Site A4 1285 Georgetown Street

Site Map on Back of Sheet

Job No. EPA-228
Date: 7-20-78
Sheet 3 of 3

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	7	8	9
	Dur.Hrs.	1.0	1.0	1.0
	From	5:38	6:38	7:38
	To	6:38	7:38	8:38
	L Value	☒	☒	☒
	Max	63	62	61
	.1	62	61	60
	1	58	59	58
Switch Up	10	54	56	55
	50	52	53	52
	90	50	51	50
	99	49	50	49
	Min	45	50	46
	.5/24			
	1/24			
	8/24			
Switch Down	.5/8			
	2	57	58	57
	5	55	57	56
	20	53	55	53
	Eq	53	54	52
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		
3rd Run		
Mic/Aux		
Weighting		A
Fast Slow		
Data Erase		
Cal.		X
Altitude	152.4m	
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		
Enable Run		
Display Off		
Time Left Site		

By:

Remarks 1 Batteries fail middle of run Rep/ACC batteries

Remarks 3

Remarks 2 Smooth Flight

Calibrator GR
Cal. Level 93=70 dB
Freq. 1KHz

Site Location: A4 1285 Georgetown Street

Site Map on Back of Sheet

Site 5

Site 5 was located on the C. U. Campus near the tennis court area at the intersection of 28th and Baseline. It was at this site that most of the research was conducted during the development of the aerial package and measurements techniques. Flights to altitudes as high as 305 meters at night were conducted before it was found our that such flights may have been in violation of Federal Air Regulations.

Site 5

Date	Run No.	Time	Duration
4-12-78	1	06:07-07:07	1
4-12-78	2	07:10-08:10	1
4-12-78	3	08:40-09:40	1
4-12-78	4	09:41-10:41	1
4-12-78	5	11:42-11:42	1
4-12-78	6	12:01-13:01	1
4-12-78	7	13:03-14:03	1
4-12-78	8	14:05-15:05	1
4-12-78	9	15:26-16:26	1
4-12-78	10	16:28-17:28	1
4-12-78	11	17:30-18:00	0.5
7-19-78	1	05:40-06:40	1
7-19-78	2	07:28-08:28	1
7-19-78	3	08:30-09:30	1
7-19-78	4	09:32-10:32	1
7-19-78	5	11:05-12:05	1
7-19-78	6	12:11-13:11	1
7-19-78	7	13:29-14:29	1
7-19-78	8	14:32-15:32	1
7-19-78	9	17:03-18:03	1
7-19-78	10	18:05-19:05	1
7-19-78	11	19:20-20:20	1

Job No. EPA-228
Date: 4-12-78
Sheet 1 of 4

Community Noise Analyzer Data Sheet

Test Data

	Run No.	1	2	3
	Dur.Hrs.	1.0	1.0	1.0
	From	6:07	7.10	8:40
	To	7:07	8:10	9:40
	L Value			
Switch Up	Max	68	70	71
	.1	67	69	70
	1	63	68	69
	10	62	65	68
	50	60	62	64
	90	58	60	61
	99	57	59	60
	Min	56	57	52
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	63	67	69
	5	62	66	69
	20	61	63	66
	Eq	60	63	65
	Dn			

Check List

Bat Test	
1st Run	
2nd Run	
3rd Run	
Mic/Aux	Aux
Weighting	A
Fast Slow	Slow
Data Erase	
Cal.	94=70 dB
Altitude	152.4m
Set Time	
Clock Starts	
Start Clock	
Set Time Run	
Begins	
Enable Run	
Display Off	
Time Left Site	

By:

Remarks 1

Remarks 3 9:36 Balloon Rooled Over

Remarks 2 Construction Noise @ nearby overpass - air hammer

Calibrator
Cal. Level 94=70 dB
Freq.

Site Location: CU Campus - Base line @ 28th

Site Map on Back of Sheet

Job No. EPA-228
Date: 4-12-78
Sheet 2 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	4	5	6
	Dur.Hrs.	1.0	1.0	1.0
	From	9:41	10:42	12:01
	To	10:41	11:42	13:01
	L Value			
Switch Up	Max	74	75	68
	.1	73	74	67
	1	72	72	65
	10	69	63	63
	50	64	61	62
	90	60	60	60
	99	59	59	59
	Min	58	58	58
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	71	71	65
	5	70	68	64
	20	66	62	63
	Eq	65	63	62
	Dn			

Check List

Bat Test		
1st Run		☐
2nd Run		☐
3rd Run		☐
Mic/Aux	Aux	☐
Weighting	A	☐
Fast Slow		☐
Data Erase		☐
Cal.	94=70 dB	☐
Altitude	152.4m	☐
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		☐
Enable Run		☐
Display Off		☐
Time Left Site		☐

By:

Remarks 1 10:00 air hammer still in operation
10:15 const. crew on break

Remarks 3

Remarks 2 10:45 wind picking up

Calibrator
Cal. Level 94=70 dB
Freq. 1KHz

Site Location: Site A5 CU Campus - Field near tennis courts; Intersection of Baseline and 28th

Site Map on Back of Sheet

Job No. EPA-228
Date: 4-12-78
Sheet 3 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	7	8	9
	Dur.Hrs.	1.0	1.0	1.0
	From	13:03	14:05	15:26
	To	14:03	15:05	16:26
	L Value			
Switch Up	Max	71	70	77
	.1	71	69	75
	1	67	65	71
	10	64	63	64
	50	62	61	62
	90	60	60	61
	99	59	59	60
	Min	58	58	59
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	66	64	68
	5	64	64	65
	20	63	62	63
	Eq	62	62	63
	Dn			

Check List

Bat Test ☐
1st Run ☐
2nd Run ☐
3rd Run ☐
Mic/Aux ☐
Weighting ☐
Fast Slow ☐
Data Erase ☐
Cal. ☐
Altitude ☐
Set Time
Clock Starts ☐
Start Clock
Set Time Run ☐
Begins ☐
Enable Run ☐
Display Off ☐
Time Left Site ☐

By:

Remarks 1
Construction Noise

Remarks 3 Siren 15:53

Remarks 2

Calibrator
Cal. Level 94=70 dB
Freq. 1KHz

Site Location: Baseline @ 28th

Site Map on Back of Sheet

Job No. EPA-228
Date: 4-12-78
Sheet 4 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	10	11	
	Dur.Hrs.	1.0	0.5	
	From	16:28	17:30	
	To	17:28	18:00	
	L Value	☒	☒	☒
Switch Up	Max	67	69	
	.1	67	67	
	1	65	64	
	10	63	63	
	50	62	61	
	90	61	60	
	99	60	60	
	Min	59	59	
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	64	64	
	5	64	63	
	20	63	62	
	Eq	62	62	
	Dn			

Check List

- Bat Test
- 1st Run
- 2nd Run
- 3rd Run
- Mic/Aux
- Weighting
- Fast Slow
- Data Erase
- Cal.
- Altitude
- Set Time
- Clock Starts
- Start Clock
- Set Time Run
- Begins
- Enable Run
- Display Off
- Time Left Site

By:

Remarks 1

Remarks 3

Remarks 2

Calibrator
Cal. Level 94=70 dB
Freq. 1KHz

Site Location: Site A5 CU Campus - Field near tennis courts; Intersection of Baseline and 28th

Site Map on Back of Sheet

Job No. EPA-228
Date: 7-19-78
Sheet 1 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	1	2	3
	Dur.Hrs.	1.0	1.0	1.0
	From	5:40	7:28	8:30
	To	6:40	8:28	9:30
	L Value	☒	☒	☒
Switch Up	Max	67	72	69
	.1	66	70	68
	1	63	66	66
	10	60	64	63
	50	57	62	61
	90	52	61	60
	99	50	59	58
	Min	49	58	57
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	62	65	65
	5	61	64	64
	20	59	63	62
	Eq	57	62	62
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		X
3rd Run		☐
Mic/Aux		☐
Weighting	A	☐
Fast Slow		☐
Data Erase		X
Cal.		X
Altitude	152.4m	☐
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		☐
Enable Run		☐
Display Off		☐
Time Left Site		☐

By: GS

Remarks 1

Remarks 3

Remarks 2

Calibrator GR
Cal. Level 93=70 dB
Freq. 1KHz

Site Location: Site A5 CU Campus Field near tennis courts, Intersection of Baseline and 28th Street (Rte 36)

Site Map on Back of Sheet

Job No. EPA-228
Date: 7-19-78
Sheet 2 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	4	5	6
	Dur.Hrs.	1.0	1.0	1.0
	From	9:32	11:05	12:11
	To	10:32	12:05	13:11
	L Value	☒	☒	☒
Switch Up	Max	66	68	72
	.1	66	66	68
	1	65	65	65
	10	63	63	63
	50	61	61	61
	90	60	60	60
	99	59	59	59
	Min	58	58	58
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	64	65	65
	5	64	64	64
	20	62	62	63
	Eq	61	62	62
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		
3rd Run		
Mic/Aux		
Weighting	A	
Fast Slow		
Data Erase		
Cal.		
Altitude	152.4m	
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		
Enable Run		
Display Off		
Time Left Site		

By: DM

Remarks 1

Remarks 3 12:39 Horn Honking
1:06 Thunder
1:10 Thunder

Remarks 2

Calibrator GR (5)
Cal. Level 93=70 dB, 92=70 dB
Freq. 1KHz

Site Location: Site A5 CU Campus

Site Map on Back of Sheet

Job No. EPA-228
Date: 7-19-78
Sheet 3 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	7	8	9
	Dur.Hrs.	1.0	1.0	1.0
	From	13:29	14:32	17:03
	To	14:29	15:32	18:03
	L Value			
Switch Up	Max	68	72	68
	.1	67	70	66
	1	66	67	65
	10	63	63	64
	50	62	61	62
	90	60	60	60
	99	59	59	59
	Min	58	58	58
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	65	65	65
	5	64	64	64
	20	63	62	63
	Eq	62	62	62
	Dn			

Check List

Bat Test		
1st Run		☒
2nd Run		☐
3rd Run		☐
Mic/[✓ Aux]		☐
Weighting	A	☐
Fast [✓ Slow]		☐
Data Erase		☐
Cal.		☐
Altitude	152.4m	☐
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		☐
Enable Run		☐
Display Off		☐
Time Left Site		☐

By: LG

Remarks 1

Remarks 3

Remarks 2

Calibrator
Cal. Level 93=70 dB
Freq. 1KHz

Site Location: Site A5 CU Campus

Site Map on Back of Sheet

Job No. EPA-228
Date: 7-19-78
Sheet 4 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	10	11	
	Dur.Hrs.	1.0	1.0	
	From	18:05	19:20	
	To	19:05	20:20	
	L Value	☒	☒	☒
Switch Up	Max	78	76	
	.1	81	72	
	1	72	65	
	10	63	63	
	50	61	61	
	90	60	59	
	99	58	57	
	Min	57	56	
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	66	64	
	5	64	63	
	20	62	62	
	Eq	63	61	
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		
3rd Run		
Mic/Aux		
Weighting		A
Fast Slow		
Data Erase		
Cal.		X
Altitude	152.4m	
Set Time		
Clock Starts		
Start Clock		
Set Time Run		
Begins		
Enable Run		
Display Off		
Time Left Site		

By: LG

Remarks 1 Sirens - 6:56, 7:04

Remarks 3

Remarks 2

Calibrator
Cal. Level 93=70 dB
Freq. 1KHz

Site Location: A5 CU Campus

Site Map on Back of Sheet

Site 6

Site 6 is located next to Maxwell Lake in the northwest area of Boulder. This is a quiet residential area located about one block west of Broadway, and north of Linden Avenue.

Site 6

Date	Run No.	Time	Duration
3-30-78	1	06:45-07:45	1
3-30-78	2	07:48-08:48	1
3-30-78	3	09:01-10:01	1
3-30-78	4	10:19-11:19	1
3-30-78	5	11:20-12:20	1
3-30-78	-	12:20-14:03	Aborted
3-30-78	6	14:03-15:03	1
3-30-78	7	15:03-17:00	Aborted
3-30-78	8	17:00-18:00	1
7-27-78	1	05:50-06:50	1
7-27-78	2	06:51-07:51	1
7-27-78	3	08:12-09:12	1
7-27-78	4	09:32-10:32	1
7-27-78	5	10:39-11:39	1
7-27-78	6	11:41-12:41	1
7-27-78	7	13:07-14:07	1
7-27-78	8	14:12-15:12	Aborted
7-27-78	9	14:46-15:46	1
7-27-78	10	15:48-16:48	1
7-27-78	11	16:49-17:49	1
7-27-78	12	18:03-19:03	1
7-27-78	13	19:04-20:04	1

Job No. EPA-228
Date: 3-30-78
Sheet 1 of 3

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	1	2	3
	Dur.Hrs.	1.0	1.0	1.0
	From	6:45	7:58	9:01
	To	7:45	8:58	10:01
	L Value			
Switch Up	Max	67	62	61
	.1	67	60	61
	1	56	59	59
	10	54	56	56
	50	48	53	54
	90	46	51	51
	99	46	50	48
	Min	44	48	47
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	55	58	58
	5	54	57	57
	20	52	55	55
	Eq	51	54	54
	Dn			

Check List

Bat Test
1st Run
2nd Run
3rd Run
Mic/Aux
Weighting
Fast Slow
Data Erase
Cal.
Altitude
Set Time
Clock Starts
Start Clock
Set Time Run
Begins
Enable Run
Display Off
Time Left Site

By:

Remarks 1
Plane overhead at 7:20

Remarks 3 See Remark # 2

Remarks 2 Heavy Machinery and general construction noise thru out

Calibrator
Cal. Level 94=70 dB
Freq. 1KHz

Site Location: Maxwell Lake

Site Map on Back of Sheet

Job No. EPA-228
Date: 3-30-78
Sheet 2 of 3

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	4	5	6
	Dur.Hrs.	1.0	1.0	1.0
	From	10:19	11:20	14:03
	To	11:19	12:20	15:03
	L Value	╳	╳	╳
Switch Up	Max	64	68	68
	.1	63	65	66
	1	62	61	63
	10	58	57	57
	50	55	54	53
	90	51	50	49
	99	49	47	46
	Min	44	44	44
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	61	59	61
	5	59	58	59
	20	56	56	55
	Eq	55	55	54
	Dn			

Check List

Bat Test		
1st Run		☒
2nd Run		☐
3rd Run		☐
Mic/Aux	Aux	☐
Weighting	A	☐
Fast Slow	Slow	☐
Data Erase		☐
Cal.		☐
Altitude		☐
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		☐
Enable Run		☐
Display Off		☐
Time Left Site		☐

By:

Remarks 1
General Construction noise

Remarks 3 Balloon up
14:35 Balloon down to 60.96m (wind)
14:40 Balloon back to 152.4m

Remarks 2 General Construction
Noise

Calibrator 93=70 dB
Cal. Level 70 dB
Freq. 1KHz

Site Location:

Site Map on Back of Sheet

Job No. EPA-228
Date: 3-30-78
Sheet 3 of 3

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	7		
	Dur.Hrs.	1.0		
	From	17:10		
	To	18:10		
	L Value	☒	☒	☒
Switch Up	Max	62		
	.1	60		
	1	58		
	10	54		
	50	52		
	90	50		
	99	48		
	Min	46		
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	57		
	5	55		
	20	53		
	Eq	53		
	Dn			

Check List

Bat Test ☐
1st Run ☐
2nd Run ☐
3rd Run ☐
Mic/Aux ☐
Weighting ☐
Fast Slow ☐
Data Erase ☐
Cal. ☐
Altitude
Set Time
Clock Starts ☐
Start Clock
Set Time Run ☐
Begins ☐
Enable Run ☐
Display Off ☐
Time Left Site ☐

By: ____________________

Remarks 1

Remarks 3

Remarks 2

Calibrator
Cal. Level 94=70 dB
Freq. 1KHz

Site Location: Maxwell Lake

Site Map on Back of Sheet

engineering dynamics inc

Job No. EPA-228
Date: 7-27-78
Sheet 1 of 5

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	1	2	3
	Dur.Hrs.	1.0	1.0	1.0
	From	5:50	6:51	8:12
	To	6:50	7:51	9:12
	L Value			
Switch Up	Max	57	69	64
	.1	56	67	62
	1	53	58	59
	10	50	54	55
	50	47	51	53
	90	43	49	52
	99	41	48	51
	Min	40	47	49
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	52	57	58
	5	51	55	56
	20	49	53	55
	Eq	48	52	54
	Dn			

Check List

Bat Test		
1st Run		☒
2nd Run		☒
3rd Run		☒
Mic/Aux		☐
Weighting	A	☐
Fast Slow		☐
Data Erase		☒
Cal.		☒
Altitude	152.4m	☐
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		☐
Enable Run		☐
Display Off		☐
Time Left Site		☐

By: GS

Remarks 1 Calm, dogs

Remarks 3 Start tape recorder 8:12

Remarks 2 Train

Calibrator GR
Cal. Level 92=70 dB
Freq.

Site Location: Site A 6 Maxwell Lake

Tape calibration 70 dB = -3 dB vumeter

Site Map on Back of Sheet

engineering dynamics inc

Job No. EPA-228
Date: 7-27-78
Sheet 1 of 5

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	4	5	6
	Dur.Hrs.	1.0	1.0	1.0
	From	9:32	10.39	11:41
	To	10:32	11:39	12:41
	L Value			
Switch Up	Max	63	63	61
	.1	62	58	58
	1	58	57	56
	10	54	54	54
	50	52	52	52
	90	50	51	50
	99	49	49	49
	Min	48	48	48
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	56	56	56
	5	54	55	54
	20	53	54	54
	Eq	52	53	53
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		☐
3rd Run		☐
Mic/[✓ Aux]		☐
Weighting	A	☐
Fast [✓ Slow]		☐
Data Erase		☐
Cal.		X
Altitude	152.4m	☐
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		☐
Enable Run		☐
Display Off		☐
Time Left Site		☐

By: GS

Remarks 1
Start tape side 2

Remarks 3

Remarks 2

Calibrator GR
Cal. Level 93=70 dB
Freq. 1KHz

Site Location: Site A6 Maxwell Lake Park

Site Map on Back of Sheet

Job No. EPA-228
Date: 7-27-78
Sheet 3 of 5

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	7	8	9
	Dur.Hrs.	1.0	1.0	1.0
	From	13:07	14:12	14:46
	To	14:07	15:12	15:46
	L Value			
Switch Up	Max	64		69
	.1	63		61
	1	61		57
	10	57		54
	50	53		51
	90	51		49
	99	50	NO	48
	Min	40		47
Switch Down	.5/24		DATA	
	1/24			
	8/24			
	.5/8			
	2	60		57
	5	58		55
	20	56		53
	Eq	54		52
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		
3rd Run		
Mic/Aux		
Weighting		A
Fast Slow		
Data Erase		
Cal.		X
Altitude	152.4m	
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		☐
Enable Run		☐
Display Off		☐
Time Left Site		☐

By: NO KR

Remarks 1

Remarks 3

Remarks 2 2:26 Batteries dead

Calibrator GR
Cal. Level 93=70 dB
Freq. 1KHz

Site Location: Site A6 Maxwell Lake Park

Site Map on Back of Sheet

engineering dynamics, inc

Job No. EPA-228
Date: 7-27-78
Sheet 4 of 5

Community Noise Analyzer Data Sheet

Test Data

	Run No.	10	11	12
	Dur.Hrs.	1.0	1.0	1.0
	From	15:48	16:49	18:03
	To	16:48	17:49	19:03
	L Value			
Switch Up	Max	59	60	59
	.1	58	59	55
	1	56	57	54
	10	54	54	52
	50	51	52	51
	90	50	49	50
	99	48	48	49
	Min	47	47	40
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	55	56	54
	5	54	55	53
	20	53	53	52
	Eq	52	52	51
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		
3rd Run		
Mic/[✓ Aux]		
Weighting		A
Fast [✓ Slow]		
Data Erase		
Cal.		
Altitude	152.4m	
Set Time		
Clock Starts		
Start Clock		
Set Time Run		
Begins		
Enable Run		
Display Off		
Time Left Site		

By: NO and LG

Remarks 1

Remarks 3

Remarks 2

Calibrator GR
Cal. Level 93=70 dB
Freq. 1KHz

Site Location: A6 Maxwell Lake Park

Site Map on Back of Sheet

Job No. EPA-228
Date: 7-27-78
Sheet 5 of 5

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	13		
	Dur.Hrs.	1:00		
	From	19:04		
	To	20:04		
	L Value			
Switch Up	Max	61		
	.1	60		
	1	56		
	10	53		
	50	51		
	90	49		
	99	48		
	Min	47		
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	55		
	5	54		
	20	53		
	Eq	51		
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		
3rd Run		
Mic/[✓ Aux]		
Weighting		A
Fast [✓ Slow]		
Data Erase		
Cal.		
Altitude	152.4m	
Set Time		
Clock Starts		
Start Clock		
Set Time Run		
Begins		
Enable Run		
Display Off		
Time Left Site		

By: NO

Remarks 1

Remarks 3

Remarks 2

Calibrator
Cal. Level 93=70 dB
Freq. 1KHz

Site Location: A6 Maxwell Lake Park

Site Map on Back of Sheet

engineering dynamics inc

Site 7

Site 7 was located in the playground of the Whittier Elementary School and is very close to the central section of Boulder.

Site 7

Date	Run No.	Time	Duration
4-4-78	1	06:08-07:08	1
4-4-78	2	07:08-08:08	1
4-4-78	3	08:08-09:08	1
4-4-78	4	09:12-10:12	1
4-4-78	5	10:15-11:15	1
4-4-78	6	11:32-12:32	1
4-4-78	7	12:34-13:34	1
4-4-78	8	13:38-14:38	1
4-4-78	9	14:55-15:55	1
4-4-78	10	15:57-16:57	1
4-4-78	11	17:00-18:00	1
7-24-78	1	06:15-07:15	1
7-24-78	2	07:28-08:26	1
7-24-78	3	08:27-09:27	Aborted
7-24-78	4	09:37-10:37	1
7-24-78	5	10:42-11:42	1
7-24-78	6	11:54-12:52	1
7-24-78	7	12:59-13:59	1
7-24-78	8	14:17-15:17	1
7-24-78	9	15:20-16:20	1
7-24-78	10	16:23-17:23	1
7-24-78	11	17:50-18:50	1
7-24-78	12	18:51-19:51	1

Job No. EPA-228
Date: 4-4-78
Sheet 1 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	1	2	3
	Dur.Hrs.	1	1	1
	From	6:08	7:08	8:08
	To	7:08	8:08	9:08
	L Value			
Switch Up	Max	61	62	62
	.1	60	61	61
	1	59	59	60
	10	57	58	59
	50	56	57	58
	90	55	56	57
	99	53	54	55
	Min	29	31	33
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	58	58	60
	5	58	58	59
	20	56	56	59
	Eq	56	57	58
	Dn			

Check List

Bat Test	
1st Run	
2nd Run	
3rd Run	
Mic/Aux	Aux
Weighting	A
Fast Slow	Slow
Data Erase	
Cal.	94=70 dB
Altitude	152.4m
Set Time	
Clock Starts	
Start Clock	
Set Time Run	
Begins	
Enable Run	
Display Off	
Time Left Site	

By: SR and GS

Remarks 1

Remarks 3

Remarks 2

Calibrator 94=70 dB
Cal. Level
Freq. 1KHz

Site Location: Whittier School

Site Map on Back of Sheet

Job No. EPA-228
Date: 4-4-78
Sheet 2 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	4	5	6
	Dur.Hrs.	1	1	1
	From	9:12	10:15	11:32
	To	10:12	11:15	12:32
	L Value	☒	☒	☒
	Max	64	61	67
	.1	63	56	66
	1	61	54	63
Switch Up	10	59	51	60
	50	58	45	59
	90	54	36	58
	99	52	30	57
	Min	50	28	56
	.5/24			
	1/24			
	8/24			
Switch Down	.5/8			
	2	60	53	62
	5	60	52	61
	20	58	48	60
	Eq	57	47	59
	Dn			

Check List

Bat Test		
1st Run		☒
2nd Run		☐
3rd Run		☐
Mic/Aux		☐
Weighting	A	☐
Fast [✓ Slow]		☐
Data Erase		☐
Cal.	94=70 dB	☐
Altitude	152.4m	☐
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		☐
Enable Run		☐
Display Off		☒
Time Left Site		☐

By: SR and GS

Remarks 1 Still Air

Remarks 3 Still air Recess for school

Remarks 2 Possibly bad cable to CNA repaired

Calibrator
Cal. Level 70 dB
Freq. 1000 Hz

Site Location: Whittier Elementary School

Site Map on Back of Sheet

Job No. EPA-228
Date: 4-4-78
Sheet 3 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	7	8	9
	Dur.Hrs.	1	1	1
	From	12:34	13:35	14:55
	To	13:34	14:38	15:55
	L Value			
Switch Up	Max	67	65	69
	.1	66	64	64
	1	64	62	62
	10	60	61	60
	50	59	54	59
	90	57	58	58
	99	57	57	57
	Min	56	56	56
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	63	62	62
	5	61	62	61
	20	60	60	60
	Eq	59	60	59
	Dn			

Check List

Bat Test
1st Run
2nd Run
3rd Run
Mic/Aux
Weighting
Fast Slow
Data Erase
Cal.
Altitude
Set Time
Clock Starts
Start Clock
Set Time Run
Begins
Enable Run
Display Off
Time Left Site

By:

Remarks 1

Remarks 3

Remarks 2

Calibrator
Cal. Level
Freq.

Site Location:

Site Map on Back of Sheet

engineering dynamics, inc

Job No. EPA-228
Date: 4-4-78
Sheet 4 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	10	11	
	Dur.Hrs.	1	1	
	From	15:57	17:00	
	To	16:57	18:00	
	L Value			
	Max	78	64	
	.1	72	64	
	1	67	61	
Switch Up	10	65	60	
	50	62	58	
	90	60	57	
	99	59	56	
	Min	57	55	
	.5/24			
	1/24			
	8/24			
Switch Down	.5/8			
	2	66	61	
	5	66	60	
	20	63	59	
	Eq	63	58	
	Dn			

Check List

Bat Test
1st Run
2nd Run
3rd Run
Mic/Aux
Weighting
Fast Slow
Data Erase
Cal.
Altitude
Set Time
Clock Starts
Start Clock
Set Time Run
Begins
Enable Run
Display Off
Time Left Site

By:

Remarks 1

Remarks 3

Remarks 2

Calibrator
Cal. Level
Freq.

Site Location:

Site Map on Back of Sheet

engineering dynamics inc

Job No. EPA-228
Date: 7-24-78
Sheet 1 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	1	2	3
	Dur.Hrs.	1	1	1
	From	6:15	7:26	8:27
	To	7:15	8:26	9:27
	L Value	☒	☒	☒
Switch Up	Max	65	67	
	.1	64	66	
	1	63	65	
	10	61	63	
	50	58	60	
	90	55	59	
	99	54	58	NO
	Min	53	57	
Switch Down	.5/24			DATA
	1/24			
	8/24			
	.5/8			
	2	63	65	
	5	62	63	
	20	60	62	
	Eq	60	61	
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		☐
3rd Run		☐
Mic/[✓ Aux]		☐
Weighting	A	☐
Fast [✓ Slow]		☐
Data Erase		X
Cal.		X
Altitude	152.4m	☐
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		☐
Enable Run		☐
Display Off		☐
Time Left Site		☐

By: GS

Remarks 1

Remarks 3 Batteries Died

Remarks 2

Calibrator GR
Cal. Level 92=70 dB
Freq. 1KHz

Site Location: Site A 7 Whittier School

Site Map on Back of Sheet

engineering dynamics inc

Job No. 228-EPA
Date: 7-24-78
Sheet 2 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	4	5	6
	Dur.Hrs.	1	1	1
	From	9:34	10:42	11:54
	To	10:34	11:42	12:54
	L Value	X	X	X
Switch Up	Max	65	70	64
	.1	63	66	63
	1	62	64	62
	10	60	61	60
	50	58	59	58
	90	57	57	57
	99	56	56	56
	Min	55	56	50
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	61	63	62
	5	61	62	61
	20	60	60	60
	Eq	59	59	59
	Dn			

Check List

Bat Test		
1st Run		☒
2nd Run		☐
3rd Run		☐
Mic/Aux		☐
Weighting	A	☐
Fast Slow		☐
Data Erase		☐
Cal.		☒
Altitude		☐
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		☐
Enable Run		☐
Display Off		☐
Time Left Site		☐

By: GS and KR

Remarks 1 Tape Start
9:39, 10:30 am

Remarks 3

Remarks 2 Plane 11:35

Calibrator GR
Cal. Level 93=70 dB
Freq. 1KHz

Site Location: Site A7 Whittier School

Site Map on Back of Sheet

Job No. EPA-228
Date: 7-24-78
Sheet 3 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	7	8	9
	Dur.Hrs.	1	1	1
	From	12:54	14:17	15:20
	To	13:54	15:17	16:20
	L Value			
Switch Up	Max	66	77	64
	.1	64	75	64
	1	62	68	62
	10	60	61	60
	50	58	59	58
	90	56	57	57
	99	55	56	56
	Min	55	49	55
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	61	63	62
	5	60	61	61
	20	59	60	59
	Eq	58	60	58
	Dn			

Check List

Bat Test		
1st Run		☒
2nd Run		☐
3rd Run		☐
Mic/Aux		☐
Weighting	A	☐
Fast Slow		☐
Data Erase		☐
Cal.		☒
Altitude		☐
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		☐
Enable Run		☐
Display Off		☐
Time Left Site		☐

By: KR and LG

Remarks 1

Remarks 3

Remarks 2 Pool Announcement 2:52

Calibrator GR
Cal. Level 93=70 dB
Freq. 1KHz

Site Location: Site A7 Whittier Elementary School

Site Map on Back of Sheet

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Job No. EPA-228
Date: 7-24-78
Sheet 4 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	10	11	12
	Dur.Hrs.	1	1	1
	From	16:23	17:50	18:51
	To	17:23	18:50	19:51
	L Value			
Switch Up	Max	68	65	70
	.1	64	64	68
	1	62	61	63
	10	61	59	59
	50	59	57	57
	90	58	56	56
	99	57	55	54
	Min	56	45	53
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	62	60	61
	5	61	60	60
	20	60	58	58
	Eq	59	58	58
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		☐
3rd Run		☐
Mic/Aux		☐
Weighting		A
Fast Slow		☐
Data Erase		☐
Cal.		X
Altitude	152.4m	☐
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		☐
Enable Run		☐
Display Off		☐
Time Left Site		☐

By: LG and NO

Remarks 1 Pool Announcement 4:52; Brake Screech 5:02

Remarks 3

Remarks 2

Calibrator
Cal. Level
Freq.

Site Location: A7 Whittier Elementary School

Site Map on Back of Sheet

Site 8

Site 8 was located too close to the Boulder Airport according to the F.A.A. for flight at 500 ft; flights at 200 ft were authorized but this altitude is too low to gather any meaningful data. No data was collected at this site.

Site 9

Site 9 is located west of the University of Colorado Campus at 1000 Rosehill Drive which is a residential area.

Site 9

Date	Run No.	Time	Duration
4-6-78	1	06:00-07:00	Aborted
4-6-78	2	07:10-08:10	1
4-6-78	3	08:12-09:12	1
4-6-78	4	09:40-10:40	1
4-6-78	5	10:42-11:42	1
4-6-78	6	11:44-12:44	1
4-6-78	7	13:03-14:03	1
4-6-78	8	14:05-15:05	1
4-6-78	9	15:27-16:27	1
4-6-78	10	16:27-17:27	1
4-6-78	11	17:32-18:32	1
7-31-78	1	06:27-07:27	1
7-31-78	2	07:32-08:32	1
7-31-78	3	08:35-09:35	1
7-31-78	4	10:00-11:00	1
7-31-78	5	11:00-12:00	Aborted
7-31-78	6	12:00-13:00	Aborted
7-31-78	7	13:38-14:38	1
7-31-78	8	14:40-15:40	1
7-31-78	9	15:58-16:58	1
7-31-78	10	17:00-18:00	1
7-31-78	11	18:12-19:12	1
7-31-78	12	19:15-20:15	1

Job No. EPA-228
Date: 4-6-78
Sheet 1 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	1	2	3
	Dur.Hrs.	1.0	1.0	1.0
	From	6:00	7:10	8:12
	To	7:00	8:10	9:12
	L Value			
Switch Up	Max		58	59
	.1		57	57
	1		54	55
	10		52	53
	50		50	51
	90		47	49
	99		45	48
	Min		43	48
Switch Down	.5/24	NO		
	1/24	DATA		
	8/24			
	.5/8			
	2		53	55
	5		52	54
	20		51	52
	Eq		50	51
	Dn			

Check List

Bat Test	
1st Run	
2nd Run	
3rd Run	
Mic/Aux	Aux
Weighting	A
Fast Slow	Slow
Data Erase	
Cal.	94=70 dB
Altitude	152.4m
Set Time	
Clock Starts	
Start Clock	
Set Time Run	
Begins	
Enable Run	
Display Off	
Time Left Site	

By:

Remarks 1 Aborted

Remarks 3 Still Dogs

Remarks 2 Still

Calibrator GR
Cal. Level 70 dB = 94 CNA
Freq. 1KHz

Site Location: 1000 Rosemill Residence Site # 6

Note: 6th Street bridge over Boulder Creek under construction; roadway shut-resident commented that traffic is minimal due to bridge being shut

Site Map on Back of Sheet

engineering dynamics, inc

Job No. EPA-228
Date: 4-6-78
Sheet 2 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	4	5	6
	Dur.Hrs.	1.0	1.0	1.0
	From	9:40	10:42	11:44
	To	10:40	11:42	12:44
	L Value	☒	☒	☒
Switch Up	Max	68	67	64
	.1	61	65	61
	1	58	60	58
	10	54	55	55
	50	51	52	51
	90	49	50	49
	99	48	48	48
	Min	47	47	48
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	57	58	57
	5	55	56	56
	20	53	54	55
	Eq	52	53	54
	Dn			

Check List

Bat Test	
1st Run	
2nd Run	
3rd Run	
Mic/Aux	
Weighting	A
Fast Slow	
Data Erase	
Cal.	70 dB - 94
Altitude	152.4m
Set Time Clock Starts	
Start Clock Set Time Run Begins	
Enable Run	
Display Off	
Time Left Site	

By:

Remarks 1 Dogs, still air

Remarks 3

Remarks 2 Still Air

Calibrator
Cal. Level
Freq.

Site Location: Site # 6 1000 Rosemill Residence

Site Map on Back of Sheet

Job No. EPA-228
Date: 4-6-78
Sheet 3 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	7	8	9
	Dur.Hrs.	1.0	1.0	1.0
	From	13:03	14:05	15:27
	To	14:03	15:05	16:27
	L Value	X	X	X
Switch Up	Max	62	64	62
	.1	57	60	60
	1	54	58	57
	10	52	53	52
	50	50	50	50
	90	49	49	49
	99	48	48	48
	Min	47	47	39
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	54	57	56
	5	53	54	54
	20	51	52	51
	Eq	51	51	51
	Dn			

Check List

Bat Test		
1st Run		☐
2nd Run		☐
3rd Run		☐
Mic/Aux	Aux	☐
Weighting	A	☐
Fast Slow	Slow	☐
Data Erase		☐
Cal.	94=70 dB	☐
Altitude	152.4m	☐
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		☐
Enable Run		☐
Display Off		☐
Time Left Site		☐

By:

Remarks 1

Remarks 3

Remarks 2

Calibrator 94=70 dB
Cal. Level
Freq.

Site Location:

Site Map on Back of Sheet

Job No. EPA-228
Date: 4-6-78
Sheet 4 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	10	11	12
	Dur.Hrs.	1.0	.5	
	From	16:27	17:32	
	To	17:27	18:02	
	L Value			
Switch Up	Max	60	58	
	.1	58	57	
	1	55	54	
	10	52	52	
	50	50	50	
	90	49	48	
	99	48	47	
	Min	48	46	
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	54	54	
	5	53	53	
	20	51	51	
	Eq	51	50	
	Dn			

Check List

Bat Test
1st Run
2nd Run
3rd Run
Mic/Aux
Weighting
Fast Slow
Data Erase
Cal.
Altitude
Set Time
Clock Starts
Start Clock
Set Time Run
Begins
Enable Run
Display Off
Time Left Site

By:

Remarks 1

Remarks 3

Remarks 2

Calibrator
Cal. Level
Freq.

Site Location:

Site Map on Back of Sheet

Job No. EPA-228
Date: 7-31-78
Sheet 1 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	1	2	3
	Dur.Hrs.	1.0	1.0	1.0
	From	6:27	7:32	8:35
	To	7:27	8:32	9:35
	L Value			
Switch Up	Max	57	64	64
	.1	55	63	62
	1	52	58	57
	10	50	52	53
	50	48	50	51
	90	46	49	50
	99	44	48	49
	Min	44	47	47
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	51	55	55
	5	50	53	54
	20	49	51	52
	Eq	48	51	52
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		
3rd Run		
Mic/Aux		
Weighting		A
Fast Slow		
Data Erase		
Cal.		X
Altitude	152.4m	
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		☐
Enable Run		☐
Display Off		☐
Time Left Site		☐

By: LG and KR

Remarks 1 Plane 6:35
Siren 6:36, 7:14

Remarks 3 Siren 8:44

Remarks 2 Plane 7:50

Calibrator GR
Cal. Level 93=70 dB
Freq. 1KHz

Site Location: A9 1000 Rosehill Drive

Site Map on Back of Sheet

Job No. EPA-228
Date: 7-31-78
Sheet 2 of 4

Community Noise Analyzer Data Sheet

Test Data

	Run No.	4	5	6
	Dur.Hrs.	1.0		
	From	10:00		
	To	11:00		
	L Value			
Switch Up	Max	64		
	.1	63		
	1	57		
	10	53		
	50	51		
	90	50		
	99	49		
	Min	48		
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	55		
	5	54		
	20	52		
	Eq	52		
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		
3rd Run		
Mic/Aux		
Weighting		A
Fast Slow		
Data Erase		
Cal.		
Altitude	152.4m	
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		
Enable Run		
Display Off		
Time Left Site		

By:

Remarks 1 Sudden brisk wind balloon movement eratic Abort Run

Remarks 3 Windy

Remarks 2 Windy

Calibrator
Cal. Level 93=70 dB
Freq. 1KHz

Site Location: A9 1000 Rosehill Drive

Site Map on Back of Sheet

Job No. EPA-228
Date: 7-31-78
Sheet 3 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	7	8	9
	Dur.Hrs.	1:00	1.0	1.0
	From	13:38	14:40	15:58
	To	14:38	15:40	16:58
	L Value			
Switch Up	Max	65	62	75
	.1	62	61	68
	1	56	59	57
	10	53	55	53
	50	51	51	51
	90	49	49	49
	99	48	47	48
	Min	47	46	47
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	56	58	55
	5	54	56	54
	20	52	54	52
	Eq	51	52	52
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		
3rd Run		
Mic/Aux		
Weighting		A
Fast Slow		
Data Erase		
Cal.		
Altitude	152.4m	
Set Time		
Clock Starts		
Start Clock		
Set Time Run		
Begins		
Enable Run		
Display Off		
Time Left Site		

By: SR and NO

Remarks 1 Smooth Flight

Remarks 3 Lawn Mower 4:30

Remarks 2 Siren 3:05 and 3:22

Calibrator
Cal. Level 93=70 dB
Freq. 1KHz

Site Location: A9 1000 Rosehill Drive

Site Map on Back of Sheet

Job No. EPA-228
Date: 7-31-78
Sheet 4 of 4

Community Noise Analyzer Data Sheet

Test Data

	Run No.	10	11	12
	Dur.Hrs.	1.0	1.0	1.0
	From	17:00	18:12	19:15
	To	18:00	19:12	20:15
	L Value			
Switch Up	Max	61	59	65
	.1	58	57	63
	1	55	54	57
	10	52	52	53
	50	50	50	50
	90	48	49	48
	99	48	48	47
	Min	47	47	46
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	53	53	55
	5	52	52	54
	20	51	51	52
	Eq	50	50	51
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		
3rd Run		
Mic/Aux		
Weighting		A
Fast Slow		
Data Erase		
Cal.		
Altitude	152.4m	
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		
Enable Run		
Display Off		
Time Left Site		

By: KR and LG

Remarks 1 Unidentified noise 5:03; Raise Balloon from 137.16m to 152.4m

Remarks 3 Siren 7:21 and 8:14

Remarks 2

Calibrator
Cal. Level 93=70 dB
Freq. 1KHz

Site Location: A9 1000 Rosehill Drive

Site Map on Back of Sheet

Site 10

Site 10 was located at Baseline Road and Foothills Parkway which is at the southeastern edge of Boulder.

Site 10

Date	Run No.	Time	Duration
4-10-78	1	06:08-07:07	1
4-10-78	2	07:10-08:10	1
4-10-78	3	08:19-09:19	1
4-10-78	4	09:21-10:21	1
4-10-78	-	10:21-12:15	Aborted
4-10-78	5	12:15-13:15	1
4-10-78	6	13:45-14_45	1
4-10-78	7	15:00-16:00	1
4-10-78	8	16:02-17:02	1
4-10-78	9	17:05-18:05	1
7-26-78	1	08:30-09:30	1
7-26-78	2	09:32-10:32	1
7-26-78	3	10:33-11:33	1
7-26-78	4	11:34-12:34	1
7-26-78	5	12:54-13:54	1
7-26-78	6	13:55-14:55	1
7-26-78	7	14:58-15:58	1
7-26-78	8	16:12-17:12	1
7-26-78	9	17:14-18:14	1
7-26-78	10	18:29-19:29	1
7-26-78	11	19:30-20:30	1

Job No. EPA-228
Date: 4-10-78
Sheet 1 of 3

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	1	2	3
	Dur.Hrs.	1.0	1.0	1.0
	From	6:08	7:10	8:19
	To	7:08	8:10	9:19
	L Value			
Switch Up	Max	64	65	64
	.1	63	64	63
	1	62	60	62
	10	60	59	60
	50	57	57	57
	90	56	55	56
	99	54	54	54
	Min	52	54	53
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	61	60	61
	5	60	59	60
	20	59	58	59
	Eq	58	57	58
	Dn			

Check List

Bat Test	
1st Run	
2nd Run	
3rd Run	
Mic/Aux	Aux
Weighting	A
Fast Slow	Slow
Data Erase	
Cal.	94=70 dB
Altitude	152.4m
Set Time	
Clock Starts	
Start Clock	
Set Time Run	
Begins	
Enable Run	
Display Off	
Time Left Site	

By: SR and GS

Remarks 1 Still Air

Remarks 3 Cloudy

Remarks 2

Calibrator
Cal. Level 94=70 dB
Freq.

Site Location: Baseline and Foothills Parkway

Site Map on Back of Sheet

Job No. EPA-228
Date: 4-10-78
Sheet 2 of 3

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	4	5	6
	Dur.Hrs.			
	From	9:21	12:15	13:45
	To	10:21	13:15	14:45
	L Value			
Switch Up	Max			
	.1			
	1			
	10			
	50			
	90			
	99			
	Min			
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2			
	5			
	20			
	Eq			
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		
3rd Run		
Mic/Aux		
Weighting	A	
Fast Slow		
Data Erase		
Cal.	94=70 dB	
Altitude	152.4m	
Set Time		
Clock Starts		
Start Clock		
Set Time Run		
Begins		
Enable Run		
Display Off		
Time Left Site		

By: SR and GS

Remarks 1

Remarks 3

Remarks 2

Calibrator
Cal. Level
Freq.

Site Location: Baseline and Foothills Parkway
no data collected.

Site Map on Back of Sheet

Job No. EPA-228
Date: 4-10-78
Sheet 3 of 3

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	7	8	9
	Dur.Hrs.	1.0	1.0	1.0
	From	15:00	16:02	17:05
	To	16:00	17:02	18:05
	L Value			
Switch Up	Max	66	66	64
	.1	62	65	63
	1	59	61	60
	10	58	58	58
	50	57	57	56
	90	56	56	55
	99	55	55	55
	Min	47	54	53
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	59	61	59
	5	59	59	58
	20	58	58	57
	Eq	57	57	57
	Dn			

Check List

Bat Test
1st Run
2nd Run
3rd Run
Mic/Aux
Weighting
Fast Slow
Data Erase
Cal.
Altitude
Set Time
Clock Starts
Start Clock
Set Time Run
Begins
Enable Run
Display Off
Time Left Site

By: RD and TF

Remarks 1 93 dB CNA=70dB
GR Cal and GLR
Snow Stops

Remarks 3 Clear Mild Wind

Remarks 2 Clear, slight wind

Calibrator
Cal. Level
Freq.

Site Location:

Site Map on Back of Sheet

Job No. EPA-228
Date: 7-26-78
Sheet 1 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	1	2	3
	Dur.Hrs.	1.0	1.0	1.0
	From	8:30	9:32	10:33
	To	9:30	10:32	11:33
	L Value	X	X	X
Switch Up	Max	70	70	69
	.1	68	68	67
	1	66	66	64
	10	62	60	61
	50	59	58	59
	90	57	56	57
	99	55	54	55
	Min	53	53	53
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	65	64	63
	5	64	62	62
	20	61	59	60
	Eq	60	59	59
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		
3rd Run		
Mic/Aux		
Weighting		A
Fast Slow		
Data Erase		
Cal.		X
Altitude	152.4m	
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		
Enable Run		
Display Off		
Time Left Site		

By: LG and GS

Remarks 1 Tree Mulchers and construction nearby

Remarks 3

Remarks 2

Calibrator GR
Cal. Level 92=70 dB
Freq. 1KHz

Site Location: Site A10 Baseline and Foothills; Chateu Village West Apts.

Original site being paved over - new highway construction

Site Map on Back of Sheet

Job No. EPA-228
Date: 7-26-78
Sheet 2 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	4	5	6
	Dur.Hrs.	1.0	1.0	1.0
	From	11:34	12:54	13:55
	To	12:34	13:54	14:55
	L Value			
Switch Up	Max	88	70	71
	.1	85	69	70
	1	73	65	66
	10	62	61	60
	50	59	59	58
	90	57	57	56
	99	55	56	55
	Min	54	55	54
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	68	64	
	5	64	63	
	20	60	60	
	Eq	63	60	
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		
3rd Run		
Mic/Aux		
Weighting		A
Fast Slow		
Data Erase		
Cal.		
Altitude	152.4m	
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		
Enable Run		
Display Off		
Time Left Site		

By: DM and KR

Remarks 1 Lawn Mower
11:47 Siren

Remarks 3

Remarks 2

Calibrator GR
Cal. Level 92=70 dB
Freq. 1KHz

Site Location: Site A10 Baseline and Foothills

Site Map on Back of Sheet

engineering dynamics, inc

Job No. EPA-228
Date: 7-26-78
Sheet 3 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	7	8	9
	Dur.Hrs.	1.0	1.0	1.0
	From	14:58	16:12	17:14
	To	15:58	17:12	18:14
	L Value	☒	☒	☒
Switch Up	Max	71	69	68
	.1	70	66	67
	1	66	63	65
	10	62	61	62
	50	59	59	59
	90	57	58	57
	99	56	57	56
	Min	54	56	55
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	65	63	64
	5	63	62	63
	20	61	61	61
	Eq	60	60	60
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		
3rd Run		
Mic/Aux		
Weighting		A
Fast Slow		
Data Erase		
Cal.		
Altitude	152.4m	
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		
Enable Run		
Display Off		
Time Left Site		

By: KR

Remarks 1

Remarks 3

Remarks 2

Calibrator GR
Cal. Level 92=70 dB
Freq. 1KHz

Site Location: Site A10 Baseline and Foothills

Site Map on Back of Sheet

engineering dynamics, inc

Job No. EPA-228
Date: 7-26-78
Sheet 4 of 4

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	10	11	
	Dur.Hrs.	1.0	1.0	
	From	18:29	19:30	
	To	19:29	20:30	
	L Value			
Switch Up	Max	65	66	
	.1	64	65	
	1	62	61	
	10	59	58	
	50	57	56	
	90	55	54	
	99	54	53	
	Min	53	52	
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	61	59	
	5	60	58	
	20	58	57	
	Eq	57	56	
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		
3rd Run		
Mic/Aux		
Weighting		A
Fast Slow		
Data Erase		
Cal.		
Altitude	152.4m	
Set Time		
Clock Starts		
Start Clock		
Set Time Run		
Begins		
Enable Run		
Display Off		
Time Left Site		

By: NO

Remarks 1

Remarks 3

Remarks 2

Calibrator GR
Cal. Level 92=70 dB
Freq. 1KHz

Site Location: A10 Baseline and Foothills

Site Map on Back of Sheet

Site 11

Site 11 is located at Martin Park which is at the very south end of Boulder.

Site 11

Date	Run No.	Time	Duration
4-7-78	1	05:52-06:52	1
4-7-78	2	06:54-07:54	1
4-7-78	3	08:26-09:26	1
4-7-78	4	09:28-10_28	Aborted
4-7-78	5	10:28-11:28	1
4-7-78	6	11:56-12:26	0.5
4-7-78	7	12:41-13:11	0.5
4-7-78	8	13:14-13:44	0.5
4-7-78	9	13:47-14:17	0.5
4-7-78	10	14:23-14:53	0.5
4-7-78	11	15:07-16:07	1
4-7-78	12	16:09-17:09	1
4-7-78	13	17:10-18:10	1
7-28-78	1,2,3	06:00-09:45	Aborted
7-28-78	4	09:45-10:45	1
7-28-78	5	10:55-11:55	1
7-28-78	6	11:56-12:56	1
7-28-78	7	13:00-14:00	Aborted
7-28-78	8	14:41-15:41	1
7-28-78	9	15:42-16:42	1

Job No. EPA-228
Date: 4-7-78
Sheet 1 of 5

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	1	2	3
	Dur.Hrs.	1	1	1
	From	5 52	6 54	8:26
	To	6 52	7:54	9:26
	L Value	☒	☒	☒
Switch Up	Max	63	63	64
	.1	62	62	62
	1	61	61	61
	10	60	60	59
	50		58	57
	90		56	56
	99		54	55
	Min		53	54
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2		61	60
	5		60	60
	20		59	58
	Eq		58	58
	Dn			

Check List

Bat Test	
1st Run	
2nd Run	
3rd Run	
Mic/Aux	Aux
Weighting	A
Fast Slow	Slow
Data Erase	
Cal.	
Altitude	152.4m
Set Time	
Clock Starts	
Start Clock	
Set Time Run	
Begins	
Enable Run	
Display Off	
Time Left Site	

By:

Remarks 1 Still Air

Remarks 3 Still Air - School kids

Remarks 2 Still Air

Calibrator 70 dB = 94
Cal. Level
Freq. 1KHz

Site Location: Site # 4 Martin Park

Site Map on Back of Sheet

Job No. EPA-228
Date: 4-7-78
Sheet 2 of 5

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	4	5	6
	Dur.Hrs.	1	1	0.5
	From	9:28	10:28	11:56
	To	10:28	11:28	12:56
	L Value			
Switch Up	Max		64	(60)
	.1		63	(54)
	1		61	(54)
	10		59	(57)
	50		57	(56)
	90		56	(55)
	99		55	(54)
	Min		49	(54)
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2		60	(58)
	5		59	(58)
	20		58	(56)
	Eq		58	(56)
	Dn			

Check List

Bat Test	
1st Run	
2nd Run	
3rd Run	
Mic/Aux	Aux
Weighting	A
Fast Slow	Slow
Data Erase	
Cal.	94=70 dB
Altitude	
Set Time	
Clock Starts	
Start Clock	
Set Time Run	
Begins	
Enable Run	
Display Off	
Time Left Site	

By: SR and GS

Remarks 1

Remarks 3 Traverse to 304.8m then ½ stat
Still Air

Remarks 2

Calibrator
Cal. Level
Freq.

Site Location:

Site Map on Back of Sheet

Job No. EPA-228
Date: 4-7-78
Sheet 3 of 5

Community Noise Analyzer
Data Sheet

Test Data

Switch Up	Run No.	7	8	9
	Dur.Hrs.	0.5	0.5	0.5
	From	12:41	13:14	13:47
	To	13:11	13:44	14:17
	L Value	☒	☒	☒
	Max	66	67	74
	.1	63	66	72
	1	59	64	64
	10	55	59	60
	50	51	56	58
	90	48	54	56
	99	46	52	53
	Min	46	50	51
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	58	63	63
	5	56	61	61
	20	53	58	60
	Eq	52	57	59
	Dn			

Check List

Bat Test
1st Run ☐
2nd Run ☐
3rd Run ☐
Mic/Aux ☐
Weighting ☐
Fast Slow ☐
Data Erase ☐
Cal. ☐
Altitude ☐
Set Time
Clock Starts ☐
Start Clock
Set Time Run ☐
Begins ☐
Enable Run ☐
Display Off ☐
Time Left Site ☐

By: RD

Remarks 1 Altitude travers 19.2m

Remarks 3 Altitude travers 76.2m

Remarks 2 Altitude Travers 38.1m

Calibrator
Cal. Level 94=70 dB
Freq. 1KHz

Site Location: Martin Park

Site Map on Back of Sheet

Job No. EPA-228
Date: 4-7-78
Sheet 4 of 5

Community Noise Analyzer Data Sheet

Test Data

	Run No.	10	11	12
	Dur.Hrs.	0.5	1	1
	From	14:23	15:07	16:04
	To	15:53	16:07	17:04
	L Value			
Switch Up	Max	68	67	74
	.1	65	66	70
	1	62	64	63
	10	60	60	60
	50	58	58	58
	90	57	57	57
	99	55	56	56
	Min	55	50	55
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	61	63	61
	5	61	61	60
	20	54	60	54
	Eq	54	54	54
	Dn			

Check List

Bat Test ____ ☐
1st Run ____ ☐
2nd Run ____ ☐
3rd Run ____ ☐
Mic/Aux ____ ☐
Weighting ____ ☐
Fast Slow ____ ☐
Data Erase ____ ☐
Cal. ____ ☐
Altitude ____ ☐
Set Time ____
Clock Starts ____ ☐
Start Clock
Set Time Run ____ ☐
Begins ____ ☐
Enable Run ____ ☐
Display Off ____ ☐
Time Left Site ____ ☐

By: ____

Remarks 1

Remarks 3

Remarks 2

Calibrator
Cal. Level
Freq.

Site Location:

Site Map on Back of Sheet

Job No. EPA-228
Date: 4-7-78
Sheet 5 of 5

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	13		
	Dur.Hrs.	1		
	From	17 10		
	To	18 10		
	L Value	☒	☒	☒
Switch Up	Max	62		
	.1	61		
	1	61		
	10	59		
	50	58		
	90	57		
	99	55		
	Min	55		
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	61		
	5	60		
	20	[illegible]		
	Eq	58		
	Dn			

Check List

Bat Test ☐
1st Run ☐
2nd Run ☐
3rd Run ☐
Mic/Aux ☐
Weighting ☐
Fast Slow ☐
Data Erase ☐
Cal. ☐
Altitude ☐
Set Time
Clock Starts ☐
Start Clock
Set Time Run ☐
Begins ☐
Enable Run ☐
Display Off ☐
Time Left Site ☐

By:

Remarks 1

Remarks 3

Remarks 2

Calibrator
Cal. Level
Freq.

Site Location:

Site Map on Back of Sheet

Job No. EPA-228
Date: 7-28-78
Sheet 1 of 3

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	1	2	3
	Dur.Hrs.			
	From			
	To			
	L Value			
Switch Up	Max			
	.1			
	1	NO		
	10			
	50		DATA	
	90			
	99			
	Min			
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2			
	5			
	20			
	Eq			
	Dn			

Check List

Bat Test
1st Run
2nd Run
3rd Run
Mic/Aux
Weighting
Fast Slow
Data Erase
Cal.
Altitude
Set Time
Clock Starts
Start Clock
Set Time Run
Begins
Enable Run
Display Off
Time Left Site

By: GS

Remarks 1

Remarks 3

Remarks 2

Calibrator GR
Cal. Level 92=70 dB
Freq. 1KHz

Site Location: Site All Martin Park

High Winds

Site Map on Back of Sheet

engineering dynamics, inc

Job No. EPA-228
Date: 7-28-78
Sheet 2 of 3

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	4	5	6
	Dur.Hrs.	1	1	1
	From	9:45	10:55	11:56
	To	10:45	11:55	12:56
	L Value	☒	☒	☒
Switch Up	Max	83	87	78
	.1	83	87	73
	1	68	68	67
	10	61	62	63
	50	58	59	60
	90	57	57	57
	99	55	55	55
	Min	52	53	54
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2	65	65	65
	5	63	63	67
	20	59	61	62
	Eq	61	62	61
	Dn			

Check List

Bat Test		
1st Run		☒
2nd Run		☐
3rd Run		☐
Mic/Aux		☐
Weighting	A	☐
Fast Slow		☐
Data Erase		☐
Cal.		☒
Altitude		☐
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		☐
Enable Run		☐
Display Off		☐
Time Left Site		☐

By: GS

Remarks 1

Remarks 3 Heavy Winds Drop Balloon to approx. 30.48m Some knocking heard

Remarks 2 Severe Statis-11:26-11:28 Split Second power loss - 11:29

Calibrator GR
Cal. Level 92=70 dB
Freq. 1KHz

Site Location: Site All Martin Park

Site Map on Back of Sheet

engineering dynamics, inc

Job No. EPA-228
Date: 7-28-78
Sheet 3 of 3

Community Noise Analyzer
Data Sheet

Test Data

	Run No.	7	8	9
	Dur.Hrs.	1	1	1
	From	~~14:40~~	14:41	15:42
	To	~~15:40~~	15:41	16:42
	L Value			
Switch Up	Max		78	76
	.1		73	72
	1		65	67
	10		62	61
	50		58	57
	90		56	55
	99		55	53
	Min		54	52
Switch Down	.5/24			
	1/24			
	8/24			
	.5/8			
	2		66	65
	5		64	62
	20		59	58
	Eq		60	59
	Dn			

Check List

Bat Test		
1st Run		X
2nd Run		
3rd Run		
Mic/Aux		
Weighting		A
Fast Slow		
Data Erase		
Cal.		
Altitude	152.4m	
Set Time		
Clock Starts		☐
Start Clock		
Set Time Run		☐
Begins		
Enable Run		
Display Off		
Time Left Site		

By: DM

Remarks 1 Windy Stopped
Run

Remarks 3 Windy Rain, Took Balloon down
5:55 left site - called office

Remarks 2 Windy Balloon Changing
Elevation - Down to 60.96m

Calibrator DM
Cal. Level 93=70 dB
Freq.

Site Location: Site All Martin Park

Site Map on Back of Sheet

engineering dynamics, inc

SECTION 7

TECHNICAL DISCUSSION

OPTIMUM ALTITUDE

There is no one altitude that is optimum. To reduce the number of measurement locations one would desire the highest possible altitude for each measurement. Another reason for a high altitude is that during normal weather the balloon will move randomly within a circle over the ground point, adding additional statistical validity to the data. There are four constraints which may mandate lower altitudes.

The first is loss of high frequency sound energy through absorption. Generally for a spectrum such as we have in a community, absorption becomes measureable beyond 300 meters. Figures 20 and 21 show octave band spectra as a function of altitude. At 275 meters and above the high frequency part of the spectrum, say 2000 Hz, begins to decay more rapidly due to atmospheric absorption. On this basis we should consider 275 meters AGL as an upper bound caused by this constraint. The 4000 Hz curve does not show similar appreciable attenuation with altitude most probably because the signal is very close to the system's noise floor.

The second is the balloon package itself. The lift capacity of the balloon depends on the barometric altitude. The load is both the fixed weight of the package and the variable weight of the restraining line. An additional force, which can be considered as a load, is the aerodynamic load (lift) at low but finite wind speeds. This force cannot be relied upon to carry additional load since wind speed is variable. Another factor which can be considered as a load factor is up or down drafts (vertical movement of the air in which the balloon resides). If the balloon is raised to its maximum possible height during a warm, sunny day, it is unlikely that that particular altitude can be maintained throughout a 24 hour period. Experience during development testing of the aerial package has shown that it has been possible to maintain balloon altitudes as high as 365 meters AGL for a 24 hour period. In worst case situations, at Boulder altitude 1676 meters MSL, early morning hours and sinking stratified air masses, the highest practical altitude was as low as 259 meters AGL. On the other hand, it was found that altitudes as high as 1000 meters could be reached for several hours.

The third factor is wind speed. As wind speed increases the drag load increases. To accommodate this load, the balloon moves downwind to cause the line to form an angle that balances both vector components. Since the line is of constant length, the balloon must descend causing an altitude change from the previous, less windy period. When the balloon has excess lift at lower altitudes, this effect is lessened. The safety factor of lower altitude when sudden winds arise also suggests lower altitudes. Experience suggests that altitudes less than 457 meters AGL are suitable.

The minimum altitude is also of interest. Terrain and structural shielding at low altitudes reduces the integration effect and causes local sources to be predominant. Figures 20 and 21 clearly show this effect. The average height of the trees and buildings on the relatively flat terrain were near 15 meters. We see from the figures that 60 meters (four structure heights) is needed to get complete freedom from these shielding effects.

ACOUSTIC POWER OF BOULDER

One of the prime objectives of the program was to measure the acoustic power emitted by the City of Boulder and to determine if there is a difference between the winter and summer season as would be intuitively suspected. If this is true, then it would be possible by the aerial monitoring technique to determine if a community is getting noisier or quieter and if a noise control program is in effect working. The computation of acoustic power of the City of Boulder is based upon the following assumptions:

1. That at an altitude of 152m above the city the city can be treated as a plane source.

2. The atmospheric attenuation at 152m is negligible.

3. The average L_{eq} value represents the average power.

Proceeding with these assumptions and using the flight data from the winter and summer seasons the acoustic power levels were computed for the L_{eq} and L_{10}.

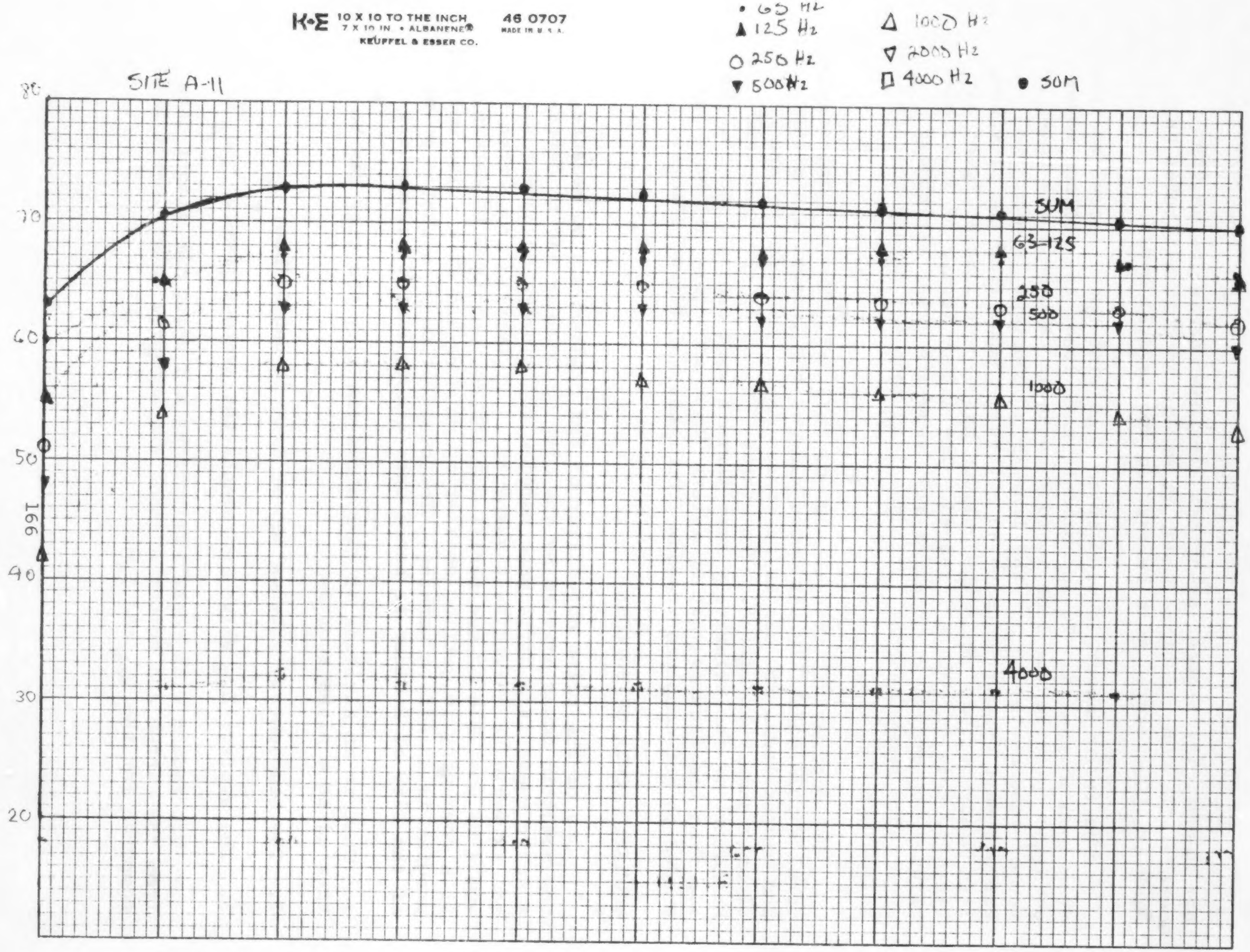
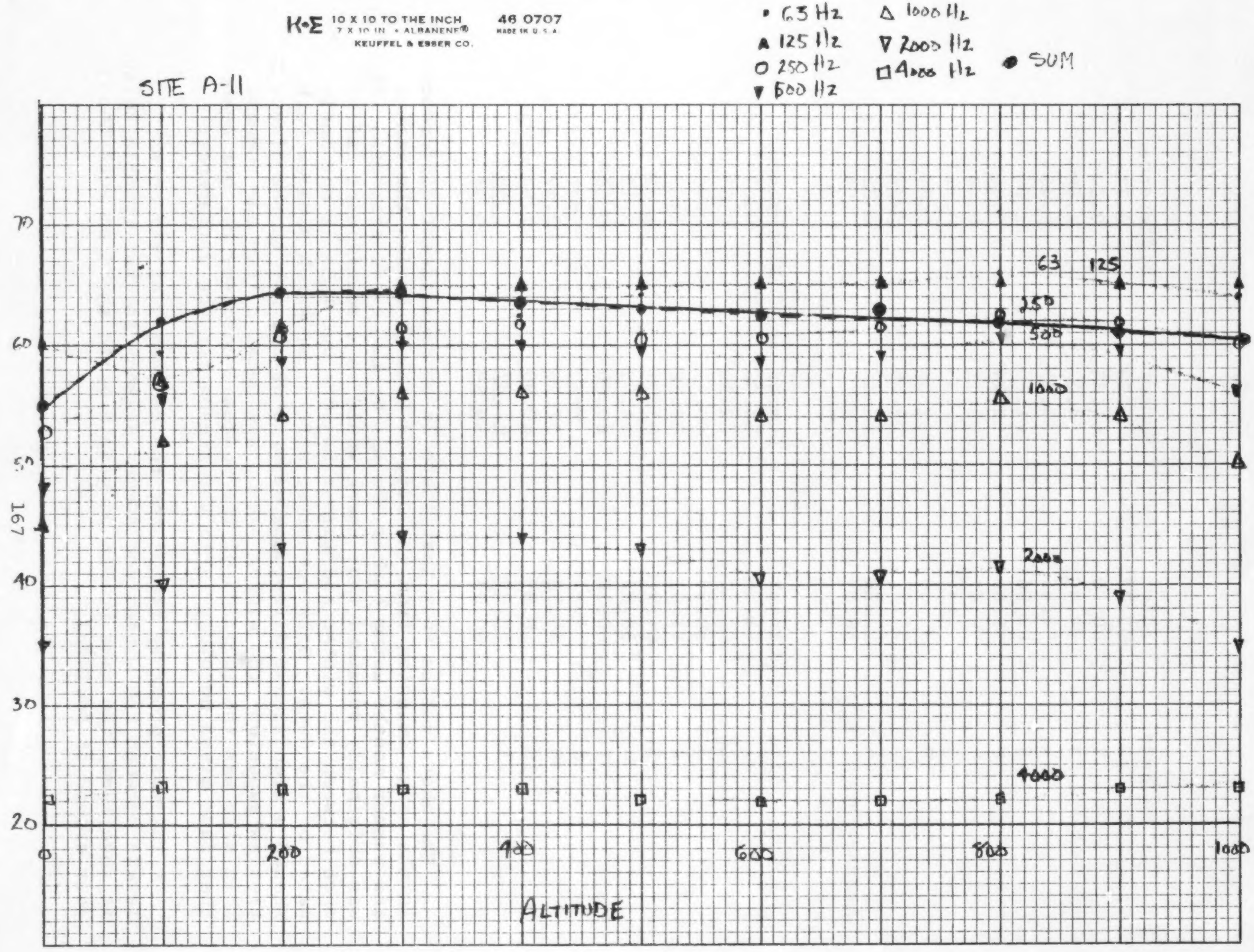

K•E 10 X 10 TO THE INCH 7 X 10 IN. • ALBANENE® KEUFFEL & ESSER CO.
46 0707 MADE IN U.S.A.
SITE A-11
• 63 Hz
▲ 125 Hz
○ 250 Hz
▼ 500 Hz
△ 1000 Hz
▽ 2000 Hz
□ 4000 Hz
● SUM
80
70
60
50
40
30
20
166
SUM
63-125
250
500
1000
4000

Figure 20



4/7/78

Figure 21

L_{eq}

Site	Winter	Summer	Difference
1	52.37	53.08	0.71
2	60.09	60.63	0.54
3	58.80	54.22	4.58
4	54.46	53.01	1.45
5	62.86	61.66	1.20
6	53.88	52.24	1.64
7	58.67	59.11	0.44
8	---	---	---
9	50.36	51.05	0.69
10	57.36	59.68	2.32
11	57.88	60.72	2.84
Average Total L_{eq}	58.07	58.13	0.06

L_{10}

Site	Winter	Summer	Difference
1	54.15	54.08	0.07
2	63.47	62.90	0.57
3	58.34	56.49	1.85
4	55.91	54.68	1.23
5	64.9	63.01	1.89
6	56.22	54.03	2.19
7	60.10	60.60	0.50
8	---	---	---
9	55.38	52.76	2.62
10	58.93	60.90	1.97
11	59.29	61.87	2.58
	60.03	59.69	0.34

The above tables show that there is no significant difference in the noise emission from the City of Boulder during the winter and summer months using either the L_{eq} or L_{10} as descriptors. It was originally surmised that there would be a significant difference between the winter and summer seasons but this is not indicated by the data. Only one site, site 3, at North Boulder Park showed a significant difference of 4.58 dB but not in the direction as expected; the winter season was noisier than the summer. This site was the location of the weekend measurements, but even that fact gives no clues as to the reason for the difference.

The most probably reason for the closeness of the noise levels between the winter and summer seasons is that traffic noise is invariant; the same number of people go to and from work the year around in Boulder.

By using the average summer and winter L_{eq}, the average A-weighted power of Boulder can be approximated. To do this the intensity level is first computed by:

$$I_L = (SPL + 10 \log_{10} 400/\rho oC) \text{ dB}$$

where: $SPL = L_{eq} \text{dB}$

$$\rho_o = 1.29 \, (273/T) \, (P_o/0.76) \text{ kg/m}^3$$

where: T = absolute temperature

P_o = barometric pressure in mHg.

$$C = (331.4 + .607\theta) \text{ m/sec}$$

where: θ = ambient temperature in $^{\circ}$C.

Using an average temperature of 11°C and an average barometric pressure of 625 mmHg, the intensity level is computed to to 58.8 dB. The intensity is then computed by:

$$I = 10^{IL}/10 \times I_{Ref} \text{ watt/m}^2$$

where: $I_{Ref} = 10^{-12}$ watt/m^2

thus: $I = 7.6 \times 10^{-7}$ watt/m^2

Using 3.6×10^7 m^2 as the area of Boulder the A-weighted power is then given by:

$$P_A = 7.6 \times 10^{-7} \text{ watt/m}^2 \times 3.6 \times 10^7 \text{ m}^2 = 27.4 \text{ watts}$$